PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

OCTOBER, 1937

A. PRESCOTT FOLWELL, Editor — VOL. 68, NO. 10 — W. A. HARDENBERGH, Asso. Editor

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TIMEWASTERS

Help for Santa Claus:

A manufacturer who is getting ready for Christmas writes us as follows: We are planning to market pencils in a novel package, and wish to sell them in sets of three, enclosed in an equal-sided triangular box. The pencils are round, 5/16 of an inch in diameter. Please have your Timewaster readers compute for us the exact inside measurement of a box to hold three such pencils.

The Garage Door Mystery:

A garage door to close an opening 8 ft. wide by 7 feet high consists of two equal rectangular panels, each 8 ft. wide and 3½ ft. high. The first, or upper, of these is hung from the lintel of the door frame by hinges, and the second is attached by hinges to the lower edge of the first, so that the opening is closed when the doors hang freely. The lower corners of the lower panel are constrained by guides to slide along the vertical edges of the door opening. How much space is used by the door in opening completely, and what surface bounds this space? Contributed by *John Bevan.*

The Green Grass Growing . . .

If 6 acres of grass, together with what grows on 6 acres during the time of grazing, keep 16 oxen 12 weeks, and 9 acres keep 26 oxen 9 weeks, how many oxen will 15 acres keep for 10 weeks? Contributed by *Mr. Reichstein* (we believe).

Solutions in Brief:

That extra 5 feet on the band around the world, mentioned by John Morrow, Jr., of the Arkansas Morrows (see September issue) makes quite a difference. With this added, the band has about 9½ inches to spare all around. $(5 \div 3.1416 \times 12 \div 2)$.

That guest that arrived two hours late, after having had an accident an hour after leaving home, came 200 miles. And at a reasonable rate of travel.

That problem of Mr. Anderson's has not been fully solved except by Mr. Blunk, one of our premier mathematicians. He says: "This is a splendid problem and requires quite a long solution, that is, to find the direction from which he approached the zenith. Determining the shortest path is not quite so difficult or laborious." However, Mr. Blunk finds the shortest distance to be 3380 ft., whereas Mr. Anderson gave it as 3632—and we are inclined to agree with Mr. Blunk, as the distance is not, as we see it, $3120+512=3632$ ft. We'd be glad of more comments on this—while we are waiting for that artist to come across, as promised a couple of months ago. W. A. H.

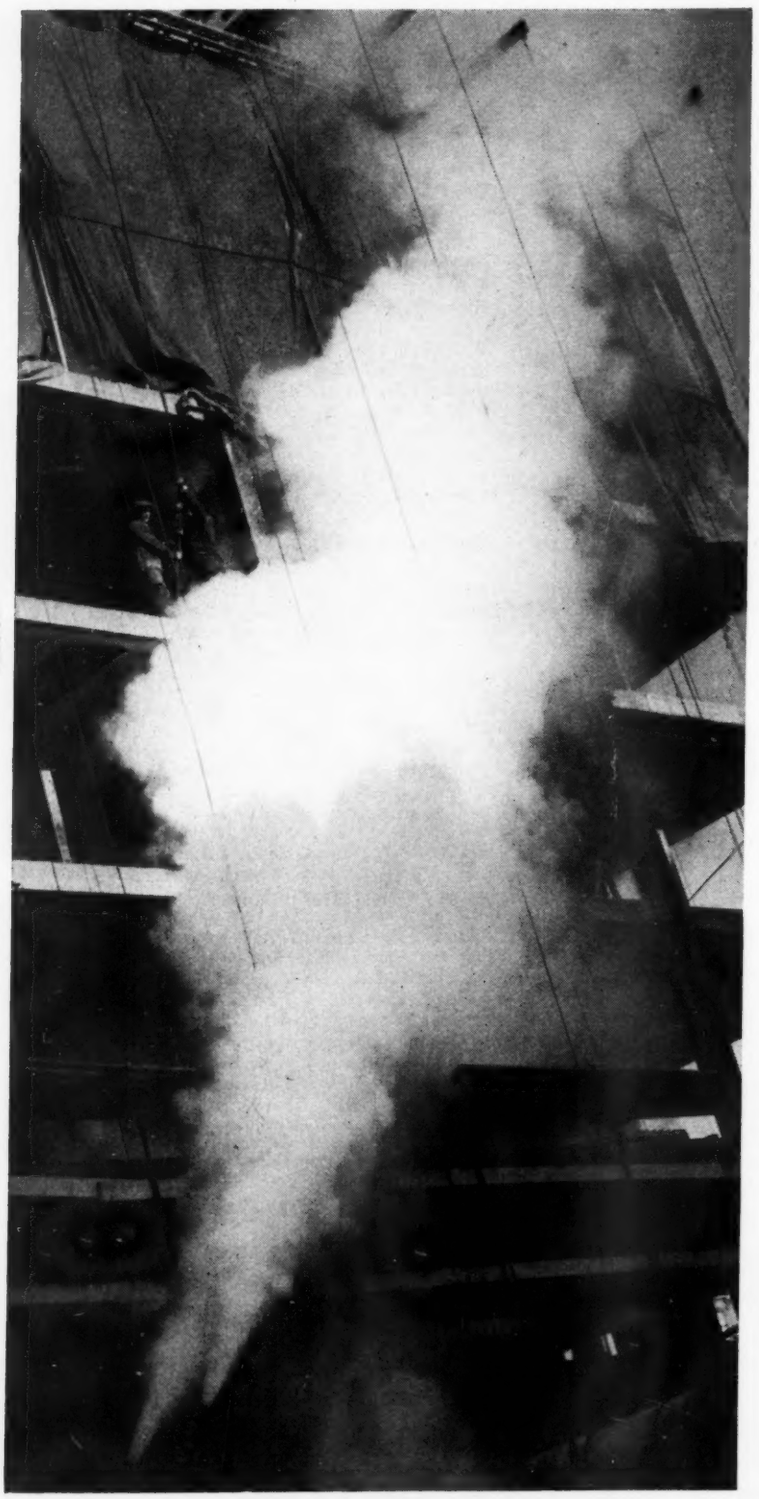
SUBSCRIPTION RATES: United States and Possessions. Canada, Mexico and Cuba, $3.00. All other countries, $4.00. Single Copies, 35 cents each.

FOUNDED IN 1896

Published monthly by the PUBLIC WORKS JOURNAL CORPORATION, 310 E. 45th St., New York, N. Y. J. T. MORRIS, *President;* W. A. HARDENBERGH, *Vice-Pres.;* CROXTON MORRIS, *Treasurer. Advertising Manager,* ARTHUR K. AKERS, 310 East 45th St., N. Y. *Advertising representatives,* FRED R. JONES, 228 No. La Salle St., Chicago, Ill.; ALONZO HAWLEY, 1635 E. 25th St., Cleveland, Ohio.

WINTER'S COMING

PLAN NOW TO CUT CONCRETING COSTS WITH 'INCOR'



IN Winter, more than at any other time, it pays to develop high concrete strengths at early periods. Heat-curing, form requirements and frost hazard are thereby reduced to a minimum—lower costs and rapid construction progress result. Reason:

Concrete hardens through chemical reaction between Portland cement and water. At 70° or above, this reaction takes place normally. As concrete temperature falls, the reaction is retarded; at or about freezing, it practically stops.

Rapid Hardening Helps

Strength development depends upon concrete temperature and not upon that of air. To overcome effect of low air temperatures, it is necessary to heat materials and retain that heat until the concrete has cured or hardened sufficiently to "go it alone." *Hence, the quicker concrete hardens, the less time and expense are required to maintain heat artificially.*

Through basic improvement in process of manufacture, 'Incor' 24-Hour Cement cures or hardens in one-fifth the usual time. That means:

1. Heat-protection costs 60 to 70 percent lower;
2. Cold-wave hazard a matter of hours instead of days;
3. Form re-use is speeded up—one set does the work of several;
4. Summer schedules can be maintained, even in dead of Winter—labor lay-offs minimized.

Figure these economies on work now in progress. Take advantage of 'Incor'* savings on cold-weather work. Get details—write for copy of "Winter Construction." Lone Star Cement Corporation, Room 2252, 342 Madison Avenue, New York. *Reg. U.S. Pat. Off.

LONE STAR CEMENT CORPORATION

MAKERS OF LONE STAR CEMENT

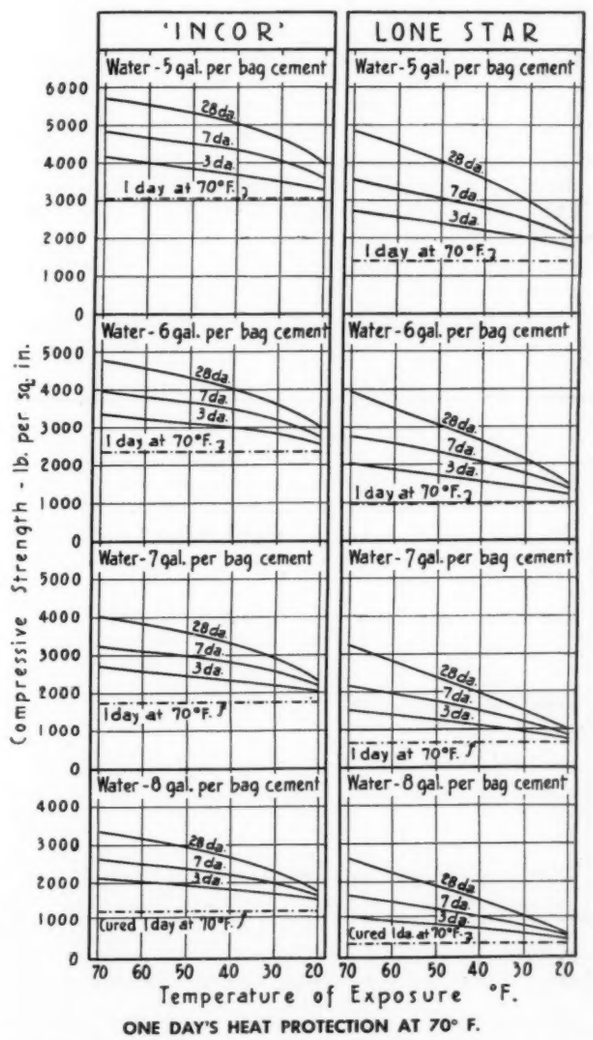
'INCOR' 24-HOUR CEMENT

When writing, we will appreciate your mentioning PUBLIC WORKS.

PUBLIC WORKS
City, County and State Engineering and Construction

OCTOBER, 1937
VOL. 68, No. 10

Economics of Concreting at Low Temperatures


'INCOR'
LONE STAR
Water - 5 gal. per bag cement
Water - 6 gal. per bag cement
Water - 7 gal. per bag cement
Water - 8 gal. per bag cement
28da.
7da.
3da.
1 day at 70°F.
Cured 1 day at 70°F.
Compressive Strength - lb. per sq. in.
Temperature of Exposure °F.
70 60 50 40 30 20

ONE DAY'S HEAT PROTECTION AT 70° F.

The above graph indicates strengths that may be expected when concrete, heated and deposited in the forms at 70°, is exposed to subnormal temperatures after heat protection for one day.

IN winter, outside construction work falls off and this means loss to the contractor, to labor and to everyone concerned. But to continue working through subfreezing weather might mean a greater loss to the contractor, for the unit cost is almost sure to be greater. It is therefore to everyone's advantage to develop methods of reducing the cost of work during such seasons. Because concrete forms such a large part of construction work of all kinds and is so greatly affected by low temperature, information concerning methods of cold-weather concreting is of general interest. The Lone Star Cement Corporation is about to publish such information ("Copyright 1937. All reproduction rights are reserved"), from advance proofs of which we have prepared the following abstract.

Two cements made by this company are used as the basis of this study—"Lone Star," a standard portland cement; and "Incor," a high-early-strength cement. In calculating costs, the former is estimated at $2 a barrel, the latter at $2.50. Presumably the relative costs, strengths, etc., given would apply to similar cements of other manufacture.

The aim of this analysis is to enable the contractor (or other user) to calculate the type, mix proportions, temperature and length of curing, which will give the desired strength at the least total cost under various air temperatures.

Temperature of the concrete from time of placing to time of attaining service strength is the basic consideration. If this temperature is maintained at 70°, the concrete hardens at the same rate in winter as in summer. If placed and cured at 50°, concrete develops less than half its normal strength at early stages, and at 28 days is still substantially below its 70° strength. At or about freezing, early strengths are less than one-quarter of normal and there is danger of frost damage.

Table I gives mix proportions and quantities per cubic yard for a range of mixes containing from 5 to 8 gal. of water per bag of cement, and for three consistencies (slump in inches) for each water content; the last to be selected to give the workability adapted to job conditions; with the service strength attained in

1, 3, 7 and 28 days if heat is maintained at 70°. It is seen, for example, that a 5-gal. mix of standard cement will be approximately as strong in three days as a 6-gallon in seven days or an 8-gallon in 28 days; and a 5-gal. mix using "Incor" considerably stronger in one day.

Table II shows the effect of duration of heating upon strength of concrete, assuming the concrete placed at 70°. (Only 5-gal. and 8-gal. mixes are shown; the 6-gal. and 7-gal. follow approximately the same law and can be interpolated.) If the outside temperature is 30° and 5-gal. Lone Star concrete be used, and if the heating to 70° be maintained only 6 hrs., the strength at the end of one day will be but 30 lb., and 1750 lb. in 28 days. But if the temperature be maintained at 70° for three days, the strength in 24 hrs. will be 1400 lb. (nearly five times as great), 2700 lb. in 3 days and 3400 lb. in 28 days. If Incor cement be used, with 6-hr. heating the 3-day strength is 40% of summer strength; and with 24-hr. heating the 3-day strength is 84% of summer strength.

Using standard cement with an 8-gal. mix, with 6-hr. heating there is practically no strength in one day and only 800 lb. in 28 days; and with 3 days heating, the strength is but 400 lb. in one day and 1450 lb. in 28 days. It is therefore apparent that water should be kept at 5 or 6 gal. in winter for work where strength is important.

If it is desired to obtain 2,000 lb. strength in 3 days, this is possible with standard cement with 6 hrs. heating at 70° and 2¾ days at 60°; or with one day at 70°; or with Incor cement with 6 hrs. at 70° and 2¾ days at 35°; or with one day at 70°.

Is it cheaper to provide only enough heat to avoid freezing risk and then wait for service strength, or to give the concrete thoroughly adequate protection until service strength is attained? This problem involves the cost of the protection and the effect of time saved on job progress and fixed overhead costs. The latter varies widely from job to job. The cost of heat production is made up of (1) cost of heating concrete aggregates. (2) cost of enclosures and of handling them, and (3) cost of supplying the heat. The first two must be incurred in any event if freezing is probable, so the 3rd is the only variable—the quicker the hardening of the concrete, the lower the heating cost. The cost of heat is therefore to be compared with increase of cement content or use of high-early-strength cement.

As an example of the method of solving such a problem, calculation is given for a building 80'x125' with 6 stories and a roof.

LONE STAR CEMENT

Temperature of Exposure °F.	Heat Protected 6 hr. at 70° F.				Heat Protected 1 day at 70° F.				Heat Protected 3 days at 70° F.			
	Compressive Strength—lb. per sq. in.											
	1d	3d	7d	28d	1d	3d	7d	28d	1d	3d	7d	28d
Total Water in Mix—5 gal. per bag of Cement												
70	1400	2700	3550	4850	1400	2700	3550	4850	1400	2700	3550	4850
60	1050	2150	2850	4000	1400	2550	3300	4450	1400	2700	3300	4500
50	750	1600	2250	3200	1400	2350	3050	4050	1400	2700	3100	4200
40	500	1200	1700	2400	1400	2150	2800	3550	1400	2700	2950	3850
30	300	850	1200	1750	1400	2000	2450	2950	1400	2700	2850	3400
20	150	400	550	700	1400	1800	2000	2150	1400	2700	2750	2900
Total Water in Mix—8 gal. per bag of Cement												
70	400	1100	1650	2600	400	1100	1650	2600	400	1100	1650	2600
60	250	800	1250	2000	400	1000	1500	2250	400	1100	1550	2350
50	150	550	950	1550	400	850	1250	1900	400	1100	1450	2000
40	100	400	700	1200	400	750	1050	1500	400	1100	1350	1700
30	50	300	500	800	400	650	850	1100	400	1100	1200	1450
20	20	150	250	350	400	500	550	650	400	1100	1150	1250

'INCOR' 24-HOUR CEMENT

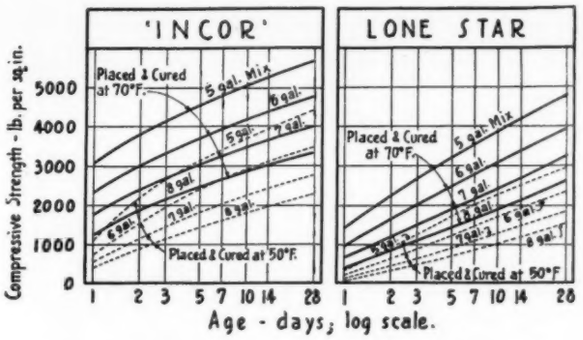
Temperature of Exposure °F.	Heat Protected 6 hr. at 70° F.				Heat Protected 1 day at 70° F.				Heat Protected 3 days at 70° F.			
	Compressive Strength—lb. per sq. in.											
	1d	3d	7d	28d	1d	3d	7d	28d	1d	3d	7d	28d
Total Water in Mix—5 gal. per bag of Cement												
70	3050	4150	4800	5700	3050	4150	4800	5700	3050	4150	4800	5700
60	2450	3600	4200	5050	3050	4000	4650	5500	3050	4150	4650	5600
50	1800	3000	3600	4400	3050	3800	4500	5300	3050	4150	4550	5400
40	1200	2350	3000	3700	3050	3650	4300	5050	3050	4150	4500	5300
30	650	1700	2250	2850	3050	3500	4050	4650	3050	4150	4400	5000
20	400	950	1300	1600	3050	3250	3600	4000	3050	4150	4300	4400
Total Water in Mix—8 gal. per bag of Cement												
70	1250	2150	2650	3400	1250	2150	2650	3400	1250	2150	2650	3400
60	950	1700	2150	2800	1250	2050	2500	3200	1250	2150	2500	3250
50	650	1350	1700	2250	1250	1900	2400	2900	1250	2150	2400	3050
40	400	1000	1350	1800	1250	1800	2200	2650	1250	2150	2350	2900
30	250	700	950	1250	1250	1700	2000	2300	1250	2150	2300	2650
20	100	350	450	600	1250	1500	1650	1800	1250	2150	2200	2300

Table II—Approximate effect of temperatures on compressive strength of concrete.

Total Water in Mix gal. per bag Cement	Slump in.	Approximate Mix by dry Volumes	Quantities per Cu. Yd.			Compressive Strength lb. per sq. in. Cured Moist at 70° F.							
			Cement bags	Sand* lb.	Gravel* lb.	'INCOR'				LONE STAR			
						1d	3d	7d	28d	1d	3d	7d	28d
	2	1:1¾:3¼	6.6	1090	2140								
5	4	1:1½:3	7.2	1010	2100	3050	4150	4800	5700	1400	2700	3550	4850
	6	1:1¼:2¾	7.8	940	2050								
	2	1:2¼:4	5.3	1240	2120								
6	4	1:2:3¾	5.8	1160	2090	2350	3400	3950	4800	950	2050	2750	3950
	6	1:1¾:3¼	6.4	1070	2050								
	2	1:3:4¾	4.5	1340	2090								
7	4	1:2½:4¼	4.9	1260	2060	1750	2700	3250	4050	650	1500	2150	3250
	6	1:2¼:3¾	5.4	1180	2030								
	2	1:3¾:5¼	4.0	1400	2050								
8	4	1:3:4¾	4.3	1340	2040	1250	2150	2650	3400	400	1100	1650	2600
	6	1:2¾:4½	4.6	1280	2010								

***Quantities of sand and gravel are based on dry materials. These quantities should be corrected for moisture and for specific gravities other than 2.65. Since these quantities are approximate, exact proportions should be established by trial batches.**

Table I—Mix proportions, quantities and strength.



Effect of placing and curing temperature on strength.

For a 6" slump, standard cement for a 5-gal. mix would cost $3.90 a cu. yd., for a 6-gal. mix $3.20, and for a 7-gal. $2.70; or for Incor cement $4.88, $4.00 and $3.38 respectively. Heating is estimated to cost $50 at 50° air temperature and $75 at 20° air temperature; forms $2,500 per floor; 5-day work-week for each floor, 5 days to strip and reassemble forms and place steel and conduits. The following tables show calculation of cost with air temperatures of 50° and 20°, and with fixed costs of $25, $50 and $100, and concrete maintained at 70°; and again at 50° air temperature and no heating.

From the first table, 50° exposure, it appears that the Lone Star mix, 6 gal., 1 day heat curing is cheapest with fixed costs at $25 a day; but as these costs increase, 3-day heat with its 2-day saving becomes most economical. Cheapest of all is Incor, 7-gal., 1-day heat.

With concrete deposited and cured at 50° (third table), the cost is greater with no expenditure for heating than any of the combinations at 70° heat curing.

With air temperature of 20°, a premium is placed on full heat protection and short curing periods if Lone Star is used. For Incor, the 7-gal., 1-day heat-cured mix is cheapest at $25 and $50 per day, time value. But when time costs approach $100 a day, the better 6-gal mix becomes cheaper, because it produces service strength in less time. These figures illustrate the savings at low temperatures from heat curing until service strength is secured.

In planning for other kinds of work—sewers, pavements, etc.—costs of heating, rate of construction and other variables will differ widely, but the general method of calculating described above can be followed.

General Conclusions

While variations in the cost of time, heating and other operations affect the relative economy of the various concrete mixes, conclusions may be drawn from the foregoing:

1. At sub-normal air temperatures, it pays to maintain concrete temperatures at 70°.
2. For air temperatures of 50° or lower, savings in time and heat protection result from the use of Incor on light construction like buildings. At higher temperatures, and for mass work, Lone Star will frequently show a favorable cost comparison.
3. With low time values and mild temperatures, a leaner mix and minimum heat protection will usually show a profit; but as time values increase and temperatures approach freezing, it is best to use sufficient heat and a mix which will produce service strength within a short time.

These conclusions refer particularly to concrete frame construction, but the same principles apply in degree to the entire range of concreting work.

It should constantly be borne in mind that the few hours after pouring concrete are the most important. Too often, protection from cold starts only after the day's concreting has been finished, usually late in the day with the thermometer dropping, resulting in the loss of much if not all of the initial heat; thus strength is sacrificed, perhaps permanently, and valuable time is lost. Concrete gains strength only when wet, and heat and moisture must go together; if dry heat is used or if some of the original moisture has evaporated, the concrete must be wet down.

At the conclusion of heat maintenance, the concrete should be allowed to cool gradually, over a period of two or three days in extremely cold weather.

It is good practice to consult the nearest weather bureau and use their information as a guide in planning protection from day to day.

The methods recommended for mixing, placing and protecting concrete, use of chemicals, etc., to secure high-grade concrete in cold weather will be described in our next issue.

50° EXPOSURE

W/R	Days Heat per Floor	Days for 2000 lbs. per sq. in.	Const. Time, Work. Days	Cement Cost 1300 cu. yd.	Heat Cost 7 Floors	Total Cost for Daily Time Value of $25	$50	$100
LONE STAR								
5 gal.	¼	5	66	$5070	—	$6720	$ 8370	$11,670
	1	3	51	5070	$350	6695	7970	10,520
6 gal.	¼	14	96	4160	—	6560	8960	13,760
	1	5	66	4160	350	6160	7810	11,110
	3	3	51	4160	1050	6485	7760	10,310
7 gal.	¼	28	156	3510	—	7410	11,310	19,110
	1	14	96	3510	350	6260	8660	13,460
	3	10	81	3510	1050	6585	8610	12,660
'INCOR'								
5 gal.	¼	2	46	6338	—	7488	8638	10,938
	¾	¾	42	6338	280	7668	8718	10,818
6 gal.	¼	3	51	5200	—	6475	7750	10,300
	1	1	42	5200	350	6600	7650	9,750
7 gal.	¼	5	66	4388	—	6038	7688	10,988
	1	2	46	4388	350	5888	7038	9,338

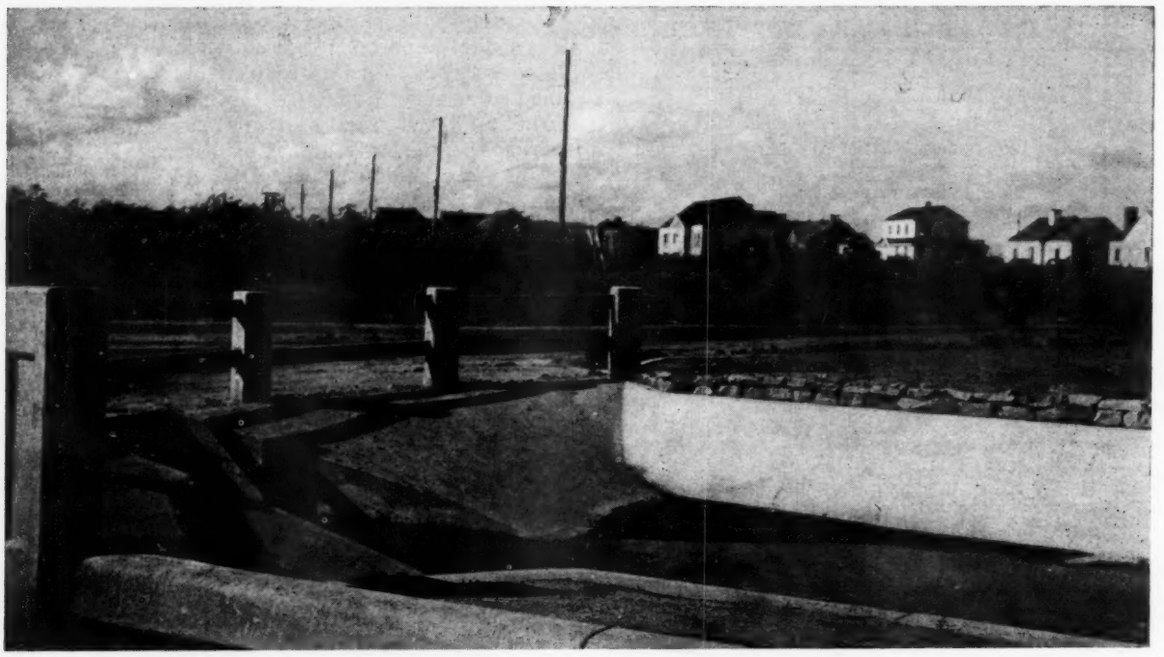
20° EXPOSURE

W/R	Days Heat per Floor	Days for 2000 lbs. per sq. in.	Const. Time, Work. Days	Cement Cost 1300 cu. yd.	Heat Cost 7 Floors	Total Cost for Daily Time Value of $25	$50	$100
LONE STAR								
5 gal.	1	10	81	$5070	$ 525	$7620	$9645	$13,695
	2½	3	51	5070	1330	7675	8950	11,500
6 gal.	3	3	51	4160	1575	7010	8285	10,835
'INCOR'								
5 gal.	¾	1	42	6338	525	7913	8963	11,063
6 gal.	1	1	42	5200	525	6775	7825	9,925
7 gal.	1	3	51	4388	525	6188	7463	10,013
	2	2	46	4388	1050	6588	7738	10,038

50° CONCRETE TEMPERATURE
50° AIR TEMPERATURE

W/R	Days for 2000 lbs. per sq. in.	Const. Time, Work. Days	Cement Cost 1300 cu. yd.	Total Cost for Daily Time Value of $25	$50	$100
LONE STAR						
5 gal.	7	66	$5070	$6720	$8370	$11,670
6 gal.	14	96	4160	6560	8960	13,760
7 gal.	28	156	3510	7410	11,310	19,110
'INCOR'						
5 gal.	2	46	6338	7488	8638	10,938
6 gal.	3	51	5200	6475	7750	10,300
7 gal.	7	66	4388	6038	7688	10,988

Table III—Calculation of relative costs.



Low flow emerges from box sewers into side channel. Flood flow from street surface goes under guard rail down paved ramp.

Solving a Difficult Problem in City Development

By P. L. BROCKWAY
City Engineer, Wichita, Kansas

JUST at the close of the active building program in the late 20's, the most active development in Wichita, Kansas, was approaching a narrow valley which was most unattractive. It was about a quarter of a mile wide, without defined drainage channels in its upper portion and with a very crooked, badly eroded channel in the lower portion. That part immediately in the path of the best development was, at that time, a conglomeration of swamp willows, cockle burrs and bubbly springs, all in what was, in normally wet seasons, a bed of oozy, black, quaky mud. Three highways crossed it at half-mile intervals on fills four to six feet high and with fairly adequate culverts.

It was just beyond the city limits but was within planning jurisdiction of the City Planning Commission, and the commission initiated studies looking toward the prevention of a permanent blight in the path of the best residential development of the city. These studies included:

First, preparation of a contour map on which to locate a street to serve as the drainage outlet.

Second, a plat of ownerships superimposed on the contours.

Third, consideration of the desirability and possibility of a parkway.

Fourth, the necessity of replatting to conform to contours with or without a parkway.

Fifth, estimating size and cost and economic feasibility of underground drainage structures.

Contours showed a considerable range of possible drain locations in the upper portion and suggested a simple channel change in the lower.

Ownerships constituted the greatest problem. Much of the area had been subdivided into small ownerships many years before. None of the owners could hope to develop or sell, individually, but none was willing to sell at a price which made it practicable to develop a parkway. Former experiences with high appraisals by the condemnation route were most discouraging, so it became a question of replatting by agreement. Some general meetings were held, many private conferences with much persuasion, some coercion, and finally recourse to condemnation on a small portion. Three appeals to the State Supreme Court on amounts of awards were settled on the basis that grading of the street in its adjusted location would not be assessed against the property.

It required nearly five years to complete the relocation of right-of-way.

Physical Development

Because of the size of the drainage area, with normal density of occupation, and because the approach grades are much greater than the run-off grade, the cost of subsurface drainage would be so great as to defeat the whole project by excessive taxation. Instead, a plan was developed using open channels, the valley being divided into three sections. In the top section the drain-

age channel is on the rear of the lots, practically a paved alley slightly depressed with curbs one foot high with their faces sloping 1 : 1. Driveway entrances may readily be cut through these curbs and given a flatter slope without affecting the main purpose.

The channel in the center section, five-eighths of a mile long, is located in a street with an 80 foot right-of-way. The center 30 feet is an ordinary roadway, with a concrete box culvert 2 feet deep by 2½ feet wide under each gutter on a 0.4% grade. A 2-foot slope from the curb up to the property line on each side gives the property a terraced lawn and provides plenty of capacity in the street area for floods that can not be carried by the small culverts, which can handle light rains and subsequent seepage without nuisance in the street.

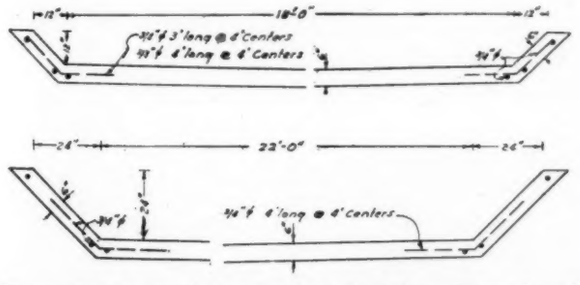
In the lowest section, the roadway is placed on one side of the right-of-way and on the other side a paved open channel designed to carry the entire flood flow. (During the negotiations a veterans' hospital was established adjoining the drainage right-of-way which does not require any access to the street across this open channel.)

Details of Design and Construction

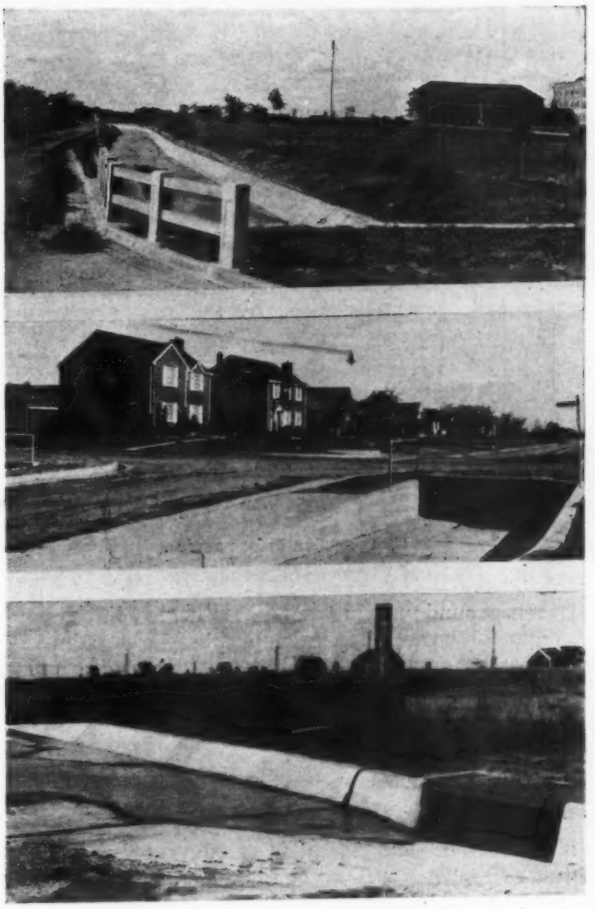
Interesting details of design were necessarily developed at the junctions of these various sections and at the crossing of the three highways. Drainage requirements and traffic safety were both involved, along with adequate entrance facilities to all building sites.

The box sewer, of which there is a total length of 7,300 feet, much of it located in ground recently filled, is so built that the combined curb and gutter forms the roof. It was the original intention to precast the curb and gutter in 5 ft. or 6 ft. sections and set them like any precast stone. This would require very close tolerance on lines and grades of the tops of the side walls, and they were finally built in place, using steel forms and curved strike-off templates and trowels riding on the forms to shape the upper surface. Form boards were laid loose on supporting jack on account of low head room. Cracks were covered with building paper. These forms were used forty or fifty times and turned back to stock in fair condition. The side forms shown in the drawing were designed to be fully adjustable in setting, to be entirely free from trench braces, to have no wires and no nails in setting except to tack the wedges in place during setting.

The floor of the box was placed first, using steel gutter forms carefully lined and graded. Vertical studs on the wall forms were notched to allow for slight variation in line and to allow for wedging to line. (This was found unnecessary.) After removal of the steel forms, the wall forms were set. These were entirely of wood in sections 16 feet long, with studs on 2-foot centers. Bracing jacks were placed on alternate studs. The horizontal section on top was double, with spreader



Above—Channel used from Sta. 54 to 69. Below—Channel used from Sta. 0 to 2 + 80.



Top—Roadway on the left, concrete-lined channel at right of it. Middle—Diversion of flood water from street intersection into planting space along drainage way and under elevated main thoroughfare. Note type of residences, built since project was started. Bottom—Low flow diverted from paved channel into box sewer under gutter.

blocks between so that they readily slipped down over the vertical studs, resting on the upper walers, which were so located as to protect the upper edge of the lagging.

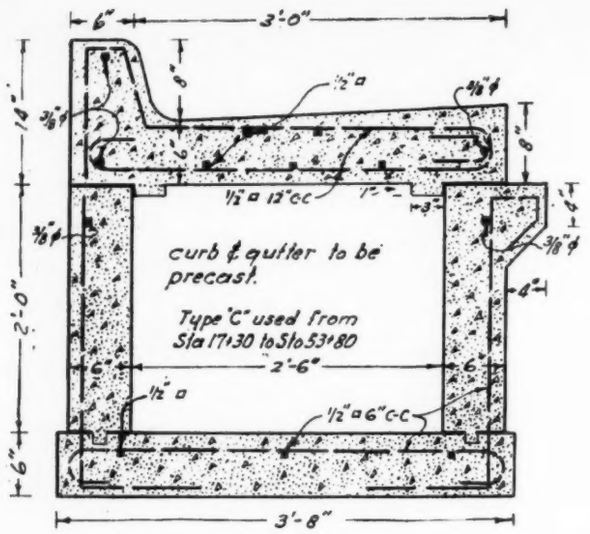
Ditches were shallow so that digging into the banks for the long jacks was not serious until deep frost, when they were abandoned and the forms were braced against the solid earth walls, still without nailing any braces or using any tie wires.

Ten sections of the forms were built of a total length of 160 feet. This meant an average use of forty-five times, and with only minor repairs they were still in good enough condition to set up in sections to build a multiple box culvert at the close of the job. After the first few times, the form setting crew could wreck and set the ten sections in time to fill them every day.

The ditch lining was laid just as a pavement slab would be, full width at one time with notched side forms for dowel seting.

Steel gutter forms were set vertical, six inches back of the upper corner of the slope pavement. The curb grade was screeded from the edge of the bottom pavement and this upper form and the surface of the concrete shaped by a special "mule" made to ride on these two lines.

Work was started rather late in the fall and continued almost without interruption through an unusually heavy ice storm, deep frost and melting snow in the trenches, as a means of keeping men on the payroll when they needed it most. No concrete was placed on



Cross-section of box sewer.

frozen ground; mixing water was heated in coils, aggregate on buried pipe, calcium chloride was admixed; chaffy wheat straw was used as cover. No frost damage occurred, although much of the concrete was placed in sub-freezing weather and a few nights reached subzero temperature.

Administrative and Financial

The earliest construction was done under the R.F.C. relief set-up. This included grading only. The depressed roadway was cut or filled as required, approximately to curb grade, temporary open earth ditches were cut on each side of a gravelled roadway in the center section and trees were set in the planting strip along the road. But the dirt ditches scoured and caved badly and were very difficult to maintain, and a proposal was submitted to W.P.A. for the completion of the project as outlined above except for the pavement itself. Under this set-up the city furnished all material, some supervision and most of the skilled labor. This expense was financed on the benefit district plan, amounting to about 40% of usual contract prices. W.P.A. furnished all unskilled labor, truck hire and most of the supervision. Technical control was handled almost exclusively by the City Engineering Department. This dual operation of the project worked out unusually well. The general foreman had had many years of experience in concrete highway and sewer construction and is one of the surviving men who came up through the various steps, competent to do any part of the work and, above all, filled with an almost holy zeal for neat work. He gathered a crew of skilled workmen who literally did plastic landscaping with concrete at some of the transition structures.

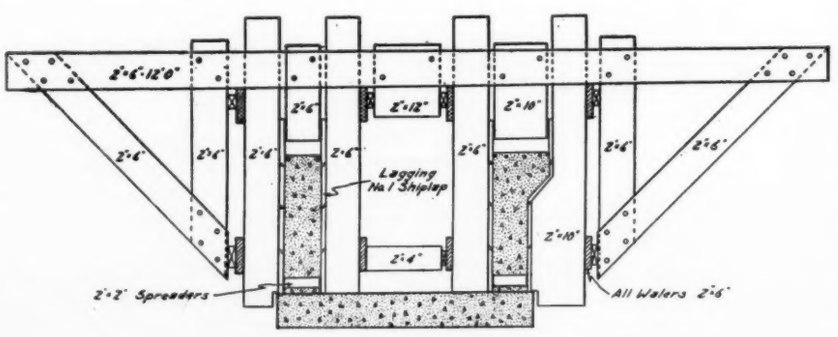
The amount contributed by R.F.C. is not exactly recorded but was approximately $25,000. Under W.P.A., the federal contribution is approximately $88,000. The contribution of the city under R.F.C. was about $8,000, and with W.P.A. has been $42,700. This is an approximate grand total of

Federal expenditure	$113,000
Local expenditure	51,000
Total	$164,000

None of these items includes engineering and administrative overhead.

The proof of the social desirability of the whole project is already in evidence. The engineering department of the city spent some time in interviewing property owners before the W.P.A. project was submitted. As soon as construction was definitely authorized, houses were started along the drainage street. The blight is definitely removed. W.P.A. has participated in a worthwhile project. The undeveloped district has contributed as much as was justified in making itself habitable.

As a final endorsement, the street has been renamed in honor of the first air casualty from Wichita and a simple shaft erected to his memory at its entrance.



Detail of forms for concrete box sewer.

Mixed-in-Place Methods in Norway

Over 60,000 sq. yd. of experimental mixed-in-place surfacings have been laid in Norway during the last three years, with satisfactory results. Pit gravel has usually been employed as aggregate on account of its cheapness, but crushed stone is preferred if available. The proportion of material passing a 2-mm. mesh is 40 to 65 per cent, 3 to 10 per cent passing an 0.074 mm.-mesh. The amount of material over 0.8 in. is kept as low as possible. The existing surface is scarified, and the loosened material mixed with the aggregate. Sufficient water is added to impart the consistency of dry concrete to the mix; in cold weather it is necessary to avoid the use of too much water, but excess moisture quickly evaporates in hot weather.

An emulsion containing 55 per cent of bitumen is used as binder; the proportion of bitumen in the mix is 4 to 5 per cent. The base receives a dressing of the emulsion at the rate of 1 gal./12 sq. yd. before spreading the mix, which should have a uniform blackish-brown color. Consolidation is effected by means of a roller not exceeding 7 tons in weight. A curing period of 2 to 3 days is necessary in hot, dry weather, and a longer interval in cold weather. A rapid-curing cutback bitumen is then applied at the rate of 1 gal./10 sq. yd.; this amount is sufficient to penetrate for about ½ in. into the surfacing, forming a waterproof crust. Stone chippings (0.08 to 0.3 in.) are applied at the minimum rate of 1 cu. ft./9 sq. yd. Maintenance consists simply in renewal of the surface dressing. Low-cost roads of this type form satisfactory bases for permanent surfacing. — *Road Abstracts;* from an article by T. Saxegaard, in *Bitumen.*

"Be Prepared"—The Watchword in Ice Control

By ROBERT L. FOSBURG

WHILE the removal of snow has long been the first consideration in winter highway maintenance, officials now recognize that the control of ice is equally important. Roads blocked by snow cause inconvenience rather than danger, but roads open to traffic, with icy surfaces, present a real hazard to motorists. Consequently, the last few years have seen a marked improvement in the ice control service rendered by state, county and city highway organizations.

The establishment of ice patrol systems, the use of mechanical spreaders, and the general practice of chemically treating abrasive materials have been largely responsible for the increased efficiency.

The operation of highway ice patrols may vary in different localities, but the objective is the same—speedy elimination of the icy pavement conditions that cause accidents, injuries and often death. These cannot be prevented unless slippery surfaces are skid-proofed almost as soon as the dangerous condition develops. It's a matter of minutes, not hours, and all ice patrol systems are designed to meet this situation. Methods employed in divisions of the Ohio State Highway Department are typical of those used by other road organizations, so a brief discussion of the Ohio system should present an accurate picture of modern ice control practice.

In winter maintenance work, the Boy Scout maxim "Be Prepared" is the watchword of every efficient highway department, since the operating speed of an ice control crew is governed by the degree of preparedness accomplished before the battle begins. Early in the fall, Ohio prepares its abrasive materials and places them in stockpiles or storage bins at convenient points along the highways. As they are delivered at the stock points, the sand or cinders are treated with calcium chloride at a rate of seventy-five pounds per cubic yard. Ohio has found that this rate of treatment keeps the materials from freezing while in storage, and yet provides the melting action which enables the grits to anchor themselves firmly when applied to icy pavements. However, a number of other states, including Michigan, Massachusetts and New Hampshire, prefer to treat the abrasives with fifty pounds of calcium chloride when preparing the stockpiles and then make an additional application of calcium chloride at the same rate, just before the materials are used on the roads.

Deciding that too much time was lost in hand-shovelling the treated grits from stockpile to truck, authorities in one Ohio highway division conceived the idea of large-capacity storage bins for sand or cinders, designed to facilitate quick loading of trucks. The bins are located at strategic spots in the areas of heaviest traffic, and are usually erected where relocations have been made on lower levels than the original roads. In this way, they can be built against a twenty-five to thirty-foot slope and advantage can be taken of the old roadway for delivery of the materials. Trucks delivering the abrasives use the old roadway for access to the bin and are able to dump the materials directly into the hoppers. The bins have a capacity of 120 cubic yards and, of course, additional material can be stockpiled nearby and pushed or shovelled into the bin when replenishments are needed. From the bin, abrasives are fed by gravity and chuted into trucks, which are driven under the bin, loaded, and on their way within two to four minutes.

Almost every state that faces the problem of ice control is turning to mechanical spreading as the fastest, most satisfactory and economical method of applying grit. The Ohio Department of Highways is no exception, and had 535 mechanical spreaders in operation at the beginning of the last winter season. This year will, undoubtedly, see a greatly increased use of mechanical spreaders by road organizations throughout the country for, in addition to the speed obtained, they give a uniform distribution of materials which is more effective and results in a considerable saving.

When a highway department has made adequate preparation, in the matters of equipment and materials, the operation of an ice patrol system becomes quite simple. The department's winter maintenance employees are divided into crews and each crew is assigned the responsibility of keeping the roads clear and safe in its particular district. A patrol district may vary from fifteen to one hundred miles of highway, depending upon the number of men and the amount of

Left—Stock pile of ice control material treated with calcium chloride. Right—Loading truck with calcium chloride treated abrasive at one of the Ohio Highway Department's roadside storage bins.

equipment available. Since it is the duty of each patrol crew to maintain clear, skidproof roads at all times, men are usually on call day or night—"set to go" whenever dangerous conditions threaten. Weather reports and predictions are watched carefully in each district, and some organizations take thermometer readings every hour to detect indications of falling temperatures. The cooperation of oil-station operators and truckers, in reporting local icy conditions, is often enlisted.

With preparation complete and plan of attack outlined, the modern ice patrol swings into action quickly

Ice patrol trucks loaded with abrasive, with spreaders attached.

Mechanical spreader applying treated grits to icy surface.

and efficiently, and can often make every road in its district safe to traffic within an hour after the start of operations.

Road organizations that have not yet established a definite ice control system will find it both wise and economical to take advantage of the benefits of chemical treatment of abrasive materials, use of mechanical spreading equipment, and establishment of highway ice patrols.

Vibrating Concrete Pavements Adds to Strength

Vibrating the concrete in a pavement as it is laid increases the strength 10 per cent, according to a report by the Bureau of Public Roads of the U. S. Department of Agriculture or, by vibrating, 10 per cent less cement can be used, and the same strength maintained.

The report gives the results of an investigation recently conducted at Arlington, Virginia. Two hundred and seventy slabs of pavement, each 10 feet wide and 8 feet long, were constructed and tested. Four different types of vibrating equipment were used, their speeds varying from 3,600 to 4,000 revolutions per minute.

Slabs of similar composition were placed and finished by standard methods without vibration. Thus, differences in the strengths and physical properties were directly attributable to vibration. In every instance it was found that vibration increased the strength and density and decreased the amount of "honeycomb," or air pockets.

To investigate the effects of vibration further, the quantities of aggregates, cement, and water were varied in slabs finished by the vibration method, and their properties were compared with those of non-vibrated slabs. Slabs 7 and 10 inches thick were placed, and the effects of surface vibration were found to extend entirely through both.

The report, published in the April 1937 issue of Public Roads, describes ways in which existing specifications for pavement concrete can be modified to utilize vibration to advantage.

A Joint City-University Sanitary Engineering Laboratory

A SANITARY engineering laboratory was dedicated in New York on September 13th which has several unusual features, housed in a building which Dean Thorndike Saville has said is "probably the finest of its kind in the United States." It is owned by the City of New York, assigned to the Department of Sanitation, but under an agreement between the city and New York University (a private institution), the latter will utilize the greater part of the building for instruction and research in sanitary engineering, with the stipulation that the laboratory shall provide facilities for sewage treatment tests, available at all times for study of current problems of the Department of Sanitation; for fundamental research on new methods of sewage disposal and related problems; for furnishing data needed for designing sewage treatment plants for the city; for studying the effect of industrial and other wastes on sewage treatment and methods of complete and partial treatment of such wastes; and for better training of sanitary engineering students in modern methods of disposal and all other sanitation topics, such as garbage digestion and bathing beach sanitation.

In addition to the above, the city receives five undergraduate scholarships whereby a regular 4-year undergraduate course in sanitary engineering, one two-year scholarship, and one post-graduate scholarship, will be furnished to employees of the Department of Sanitation, to be awarded after competitive examination.

The laboratory will be under the exclusive supervision and control of the University, which provides all of the movable laboratory equipment, including large experimental apparatus, much of which has been donated by manufacturers. It will not be confined to investigations for the city, but can conduct any researches it desires; already two projects are under way under fellowships contributed by large industrial concerns. The laboratory is particularly well equipped for studying treatment of industrial wastes.

The investigational facilities comprise not only a large and completely equipped chemical and bacteriological laboratory with special preparation, research, and stock rooms, but also numerous large tanks, pumps, filters, meters, and other equipment, which provide for handling a sewage flow of 100,000 gallons per day, or a water flow of 25,000 gallons per day through a rapid sand filter. Experiments may therefore be conducted upon a sufficiently large scale to reproduce actual conditions in practice.

Some New Features in Swimming Pools

Swimming pool at the Nutley, N. J., Country Club.

SEVERAL features of the design and construction of swimming pools built for country clubs at Allentown, Pa., Nutley, N. J., Baltimore, Md., and elsewhere are sufficiently novel or unusual to be of interest to all who contemplate installing such utilities.

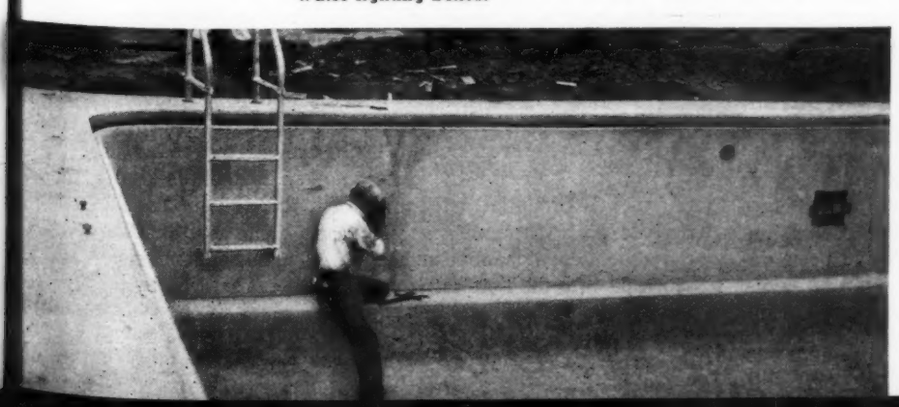
In the matter of construction, the essential new feature is the use of "gunite" instead of concrete, in the same way that this material has been used for lining reservoirs, canals, etc. by shooting it directly against the earth, without the use of expansion joints. Reinforcement (generally mesh for thin sections and rods for thick ones) is used throughout. From the bottom to a point 4 ft. below the top of the pool the sides are sloped and above this the wall is built as a vertical cantilever, capped with a self-contained, heavily reinforced horizontal slab 3 ft. wide. The interior corners are coved to a radius of 18 in. In the Allentown pool, 40x75 ft. with an adjoining children's pool 40x25 ft., the bottom lining is 2½" thick with mesh reinforcement, the slopes are 5" thick and the cantilever wall 5½", both with rod and mesh reinforcement.

The children's pool is built as an extension at the shallow end of the main pool, with an 8" wall between; the children's pool being 16" to 24" deep, and the main pool at that end 48"; these depths including a 4" freeboard. This low freeboard has proven to be attractive.

Another feature of this design is a rest step at the foot of the vertical wall. Originally intended as a strengthening feature, it is appreciated by the bathers as a place to stand and rest without leaving the water.

In connection with designing one of the first of these pools, the engineer of the Pennsylvania State Board of Health had incorporated a form of gutter which would be largely concealed by an overhang of the walk and eliminate the danger of catching a foot in the slot. A plan was developed which permitted "shooting" this construction without difficulty.

Corner of pool, showing scum gutter, ladder, step and underwater lighting boxes.



Most of these pools include a subaqueous lighting system, which adds to both attractiveness and safety for night bathing.

The cost of a 40'x100' pool at Nutley, N. J. (swimming end 40'x82') was as follows:

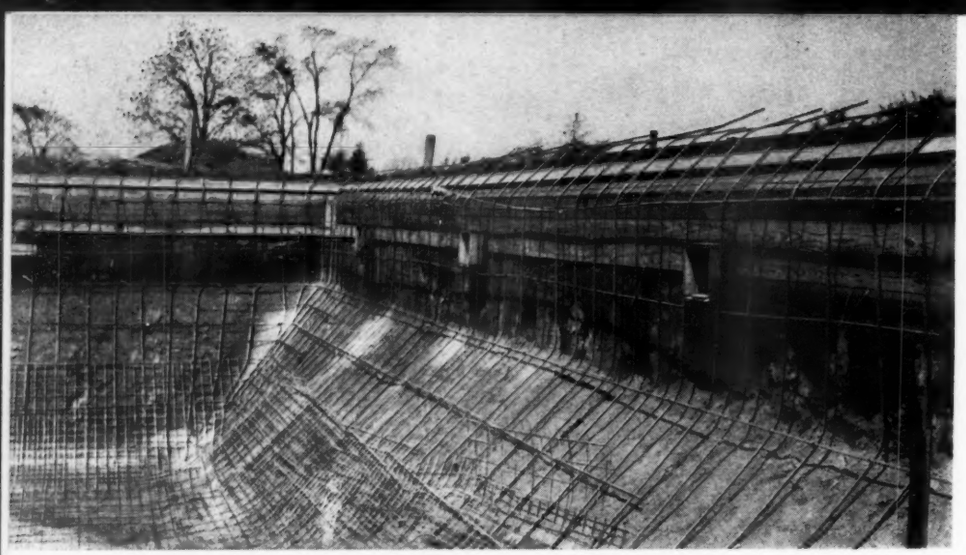
Excavation	$ 400
Pool proper with paint	5,800
Lighting	1,400
Plumbing	1,200
Filtration system	3,500
Filtration house and locker room, about	2,000
Grading and fencing	1,000
Equipment, including lockers in bath-houses, about	1,200
	$16,500

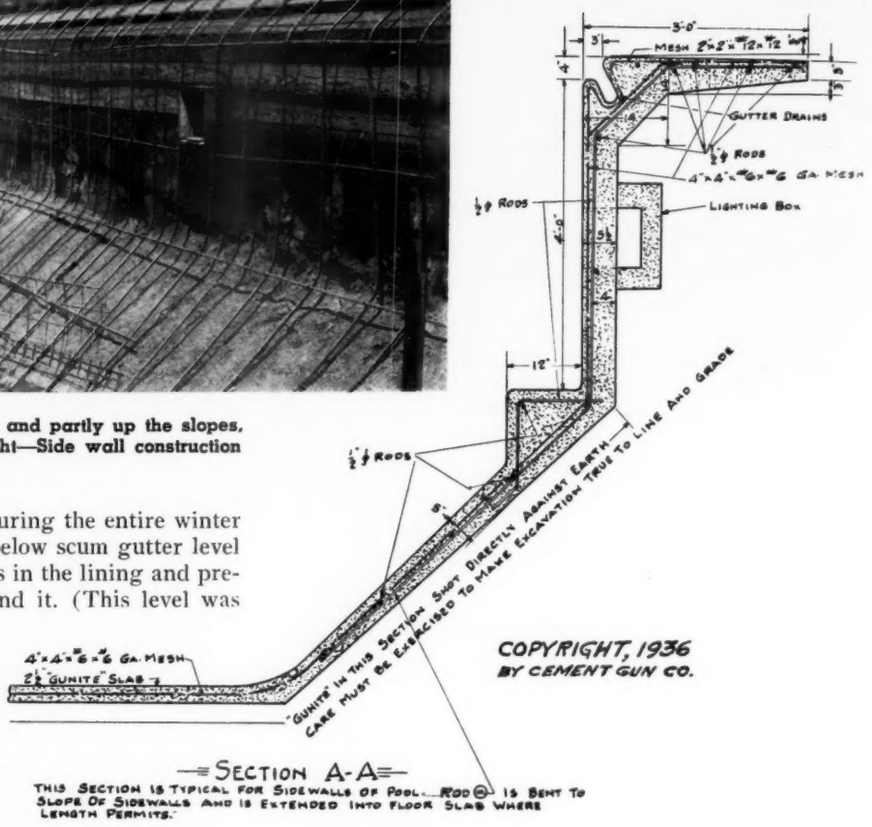
Another pool of this kind 50'x100' near Baltimore, Md., cost about $15,100, the grading and fencing and equipment items being less.

The operating costs of the Allentown pool (Lehigh Country Club), which was built in 1936 and opened for operation this year on May 29, for the eleven weeks up to August 15, were as follows:

Chemicals—chlorine (HTH) and copper sulphate for the entire season	$ 79.40
Cleaning and painting pool at beginning of season, labor $92, paint $16	108.00
Cleaning pool (once)	8.00
Repairs to paint on bath-house	9.70
Painting letters around pool	27.50
Repair parts for plumbing	17.61
Repairs to motor	7.75
New diving boards	55.68
Cocoa mats for boards	5.50
Rubber mats	44.00
Power bill up to August 15th	62.50
State permit	10.00
Liability insurance	37.50
Life guard at $100 per month to August 15th	266.67
Printing of notices of swimming meets	37.25
Expenses of special exhibition swimmer	20.00
Purchase of children's games adjacent to pool	43.70
Guest register	2.25
	$843.01

It can therefore be assumed that the cost will be about $275 a month for the swimming season of four months. In addition, there will be an expenditure of approximately $100 for placing logs in the pool, removing and storing all equipment, covering the scum gutters to prevent clogging by snow, and other similar details necessary for properly protecting the pool against winter.

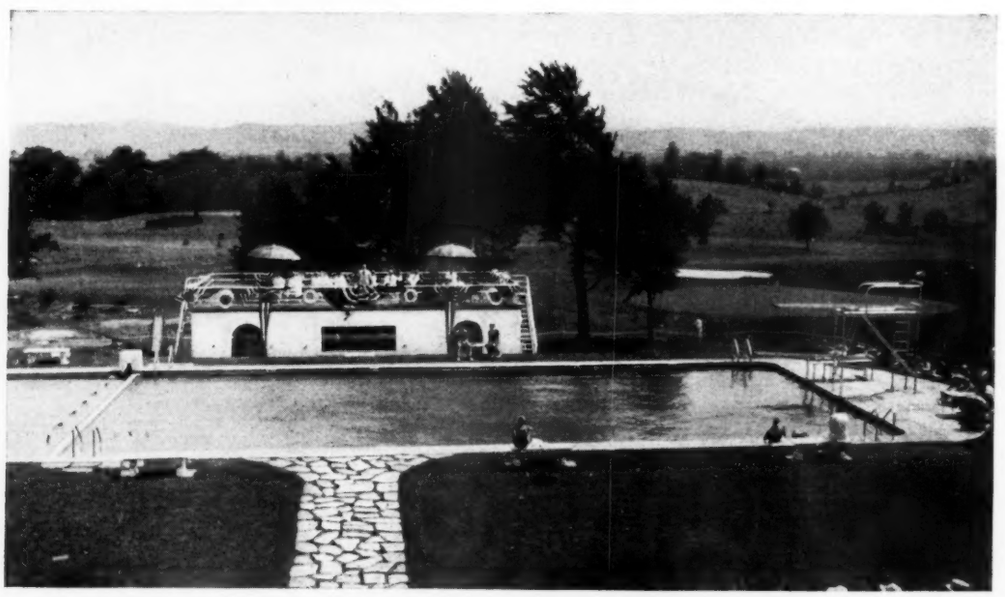




Above—Reinforcing mesh on bottom and partly up the slopes, with cantilever rods in place. At right—Side wall construction details.

Water was kept in the pool during the entire winter up to an elevation of about 8" below scum gutter level to minimize temperature changes in the lining and prevent freezing of the earth behind it. (This level was maintained without renewing the water, as there was no apparent leakage.) Logs are kept in the pool to prevent bursting due to pressure of ice on the walls, and no cracks of any kind have developed. A new coat of cold water paint is applied in the spring to freshen up the appearance. There being no expansion joints, the expenses for recalking these are avoided.

These plans have been developed and copyrighted by the Cement Gun Company.



Swimming pool of Lehigh Country Club, Allentown, Pa.

Machine-Trimming of Canal Banks

The more than 300 miles of aqueduct being built to bring Colorado river water to Southern California includes 63 miles of concrete-lined canals 56 feet wide at the top, 20 feet wide at the bottom and 12 feet deep. This gives nearly 500 acres of surface to be lined with concrete; and to secure uniform thickness of concrete these surfaces must be dressed accurately to dimension. This is being done by machines which have been developed by the contractors on the job.

One type trims the bank completely in one operation. It consists of a bucket excavator which cuts away all high spots and compacts the slopes, carrying the waste to a cross-belt which delivers it to waste banks. Another type combines the principles of the usual road grader with a bucket elevator. Both types are carried on rails laid on the sides of the canal banks. The blade-type trimmer is propelled back and forth through the canal by means of a tractor, successive cuts being made until the true grade is obtained, the waste material being crowded into the bottom, from which it is removed by a bucket elevator.

The Editor's Page

Modern Methods for Meeting Winter Emergencies

It was scarcely more than fifteen years ago that snow removal by modern methods and equipment was virtually unknown. The silhouette at the bottom of this page illustrates well snow and ice removal in the horse and buggy days. Under present-day conditions, with our dependence on continuously open roads for the movement of food, milk and commercial products, this method—whether for city streets, primary highways or farm-to-market roads—can no longer be tolerated. No excuse is needed for the presentation in this issue of equipment and materials that will keep more miles of highway open and safe at less cost.

But employment of these modern methods does not eliminate need for hand labor. It is not necessary to discontinue this means of helping the unemployed, even though the city or county use all the equipment it can afford to buy. In the cities such labor is needed for opening gutters, cleaning cross walks, clearing around fire hydrants, small jobs of ice removal and other work of various kinds. On too many highways, jobs that require hand labor are neglected, such as clearing culvert openings and the gutters leading thereto.

Snow fighting is an emergency job where time is of the utmost importance, and it calls for the use of all the equipment and all the hand labor that is obtainable.

Did You Note These Facts?

PUBLIC WORKS aims to give its readers information which will help them to build better public works, at less cost, and operate them more satisfactorily. Also which will keep them informed of the latest worth-while developments. When any of them wish information that we have not published, we are glad to answer their questions by correspondence. But some of the questions put to us have already been answered in articles in recent issues, indicating that occasionally readers overlook matter that would have been of value to them. Probably you are not one of these, but did you notice the following in the September and October issues?

Up to 6 per cent grades, increase of grade causes an increase in fuel consumption by light passenger cars which is so small as to be negligible.

Some cities find the amount of water used for air conditioning is so great that they cannot carry it away in their sewers.

About 40 per cent of American cities do not build silt basins in their storm water inlets.

Filter flies have been combatted by spreading common salt over the filter.

One city has built a two-story sewage treatment plant. Another has its entire water purification plant above ground, in steel tanks.

Too-small sand grains in a water filter are being increased in size by adding lime to the influent, which is deposited on the grains.

A 220-pound tamper, used for tamping trenches, does all the work itself—the operator just has to guide it.

Motor driving is recommended for rotary sewage distributors of the larger sizes.

A city laid a water main across a river without a cofferdam and using no equipment but a drag-line and hand tools.

Heating concrete may be profitable even when the temperature stays well above the freezing point.

One of the States finds it worth while to assemble gritty material for scattering on icy roads, in storage bins from which it can be loaded into trucks without hand labor or loss of time.

Vibrating concrete pavements permits reducing the cement used by 10 percent.

Turning sludge gas into an air-filled gas holder may form a dangerous explosive mixture. This should be avoided and can be quite easily.

A large city specifies the amount of paving of each kind that its construction gangs are expected to do per man per day.

Tastes and odors in nearly half of the water supplies so troubled are due to algae, and in nearly as many cases to leaves and decaying vegetation.

Heating sewage sludge facilitates dewatering, but causes a loss of nitrogenous matter from the sludge.

Believe it or not, there is one State whose law makers have decreed that under certain conditions twenty-seven cubic feet make *two* cubic yards.

Tomato skins have been known to stay two years and more in a digestion tank without being digested.

One city claims to account for 95.1 per cent of all the public water supply it puts into the distribution system.

A water main is being laid which is expected to expand and contract as much as 30 inches at a single joint, due to temperature changes.

A spillway is being built for a city reservoir which, after it has been finished, will be covered with ten feet of embankment.

Diversion, Debts and "Divvying"

In commenting on the reports of the Bureau of Public Roads on automobile revenues, the American Petroleum Industries Committee uses the above term, and also lists, as happening to the motorists' tax dollar, the following: 40 cents actually spent in road construction and maintenance on state highways; 25 cents allocated to city streets and rural roads; 16 cents diverted to non-highway purposes; 14 cents for payment of debts incurred to build roads; 4 cents for collection and administration expense; and 1 cent for state police. In other words, total reported diversion of highway funds last year amounted to one-third of the total funds raised through gasoline and motor vehicle taxes.

The 16 cents mentioned above as being diverted, do not represent all of the diversion, since substantial amounts of the money allocated to cities and counties are also used for non-highway purposes. For instance, both New York and Chicago receive and spend for other than street work many millions of road users' tax money.

Courtesy N. P. Nelson Iron Works, Inc.

Grading on the Sacramento Air Depot

BY KENNETH F. PARK

THE Sacramento Air Depot and Bombing Base, which is to be the repair and supply base for the Army air service in the west and will occupy an area of approximately 1,200 acres and cost about $17,000,000, is now under construction with gangs working in three 8-hour shifts.

The maximum cuts on the field run to about 7 feet with an average of 4 feet, and the maximum fills run to about 9 feet. So far as possible, the scrapers work through a series of light cuts and fills, returning back through the same series; but where heavier cuts and fills are encountered, a circular or figure 8 haul is used.

For the most part the material is loam to a depth of about 2 feet underlaid with hardpan. Two rooters are kept in operation continuously breaking up this hardpan for scraper loading. Because of the hardness of this material the contractors, Payton Brothers, make regular use of a pusher Caterpillar to speed loading. Without the pusher, the loading distance was 150 feet and the time required, 1.4 minutes; when the pusher was used, loading distance was cut to 60 feet and loading time was .5 minute. Not only does the pusher make it possible to load more quickly, but it also increases the pay load. The engineers estimated that the average pay load without the pusher was 8 cubic yards—with the pusher, 9 cubic yards.

Most of the hauling on this job was done in fifth gear because the contractor figured that the tractor tracks wore unduly when traveling in sixth gear. Both the contractor and engineers on the job approved of this slight slowing up in speed because the pusher tractors enabled the scrapers to deliver more yardage per hour even with the lower speed.

The machines are greased each shift and such small repairs as are ordinarily required are made by the operators themselves. Because of the method of working on leveling jobs, it is rather difficult to get any detailed production figures; however, here are the reports for two 8-hour shifts:

(1) During 79 tractor hours, covering the use of 10 Caterpillar tractors, 7 12-yard carryall scrapers, 2 rooters, 1 sheep-foot tamper and a pushdozer, 491 loads were delivered on a haul which averaged 660 feet one-way. Figuring an average of 8.5 cubic yards of excavation per load, this works out to 75 cubic yards per scraper hourly.

(2) During 73.5 working hours, with the same equipment and the same haul, the total number of loads delivered was 492, or approximately 81 cubic yards per scraper hourly.

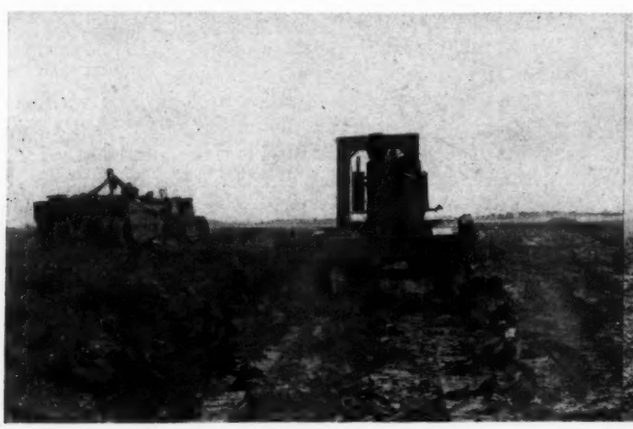
The day crew does all of the finishing and light cut and fill work where extreme accuracy is required; the heavier cuts are left for the night operators—speed can be made on these heavier cuts because there is less necessity for accuracy.

At one time as many as seventeen 12-yard scrapers were on the job, but at the time of the visit when these photographs were taken there were at work seven LeTourneau 12-yard carryall scrapers, two LeTourneau rooters, two LeTourneau bulldozers, two LeTourneau "pushdozers," three 2-section sheep-foot rollers, seven Caterpillar RD8 tractors, two Cletrac "80" gas tractors, two Caterpillar "75" Diesel tractors, and one Caterpillar "70" Diesel tractor.

Liability for Accident to Workman

A contractor for the laying of sewer mains was bonded by an indemnity company. His contract with the Sewerage and Water Board provided that the board should be held harmless against any suit which might be brought against it wherein the liability was attributable to the negligence or fault of the contractor. There was no provision for any indemnification of the board against the consequences of its own negligence.

One of the contractor's laborers was electrocuted when he touched a cable connected with the contractor's crane which was in contact with a highly charged uninsulated wire of the Sewerage and Water Board. His parents sued the board, which called in warranty the contractor and his surety. The Louisiana Court of Appeal, Buford v. Sewerage and Water Board of New Orleans, 175 La. 110, held the contractor and surety were not liable under the contract or bond.



Rooter at work in hardpan

Scrapers being loaded

Laying a Water Main Across a River Without a Coffer Dam

By ARTHUR E. J. JOHNSON
City Engineer, Red Oak, Ia.

LATE in 1936 Red Oak completed a double gravel pack well, adding 750,000 gallons per day to its water supply. This supply, however, had to be pumped across the Nishnabotna river, and the problem was presented of laying a pipe line for this purpose during the winter.

A. E. J. Johnson

At this time the stream was at its lowest, flowing about 12,000 gpm. At the point selected for the crossing it was then about 90 ft. wide at water level. Laying by the coffer dam method was considered, but in view of the volume of water flowing and the fact that the river bed was sand and gravel to a depth of 18 to 20 ft. it seemed probable that an enormous amount of water would come under coffer dam or sheet piling and have to be pumped if the pipe was to be laid in a comparatively dry trench.

The writer recommended crossing on a highway bridge, but the Water Committee, fearing the possibility of freezing, decided that the pipe should be placed under the river, and put up to him the problem of finding the best way of doing this. He remembered his experience as a very young man, in digging out a bathing hole in a river bottom of similar material; a "bath tub" dug in the sandy bottom in shallow water would last for a week or two before enough sand would wash in to fill it. There seemed to be no reason why a similar plan could not be used for this job.

The river had a quite uniform flow from day to day and was free of obstructions at this point, was about one foot deep, and ice was just beginning to form. My proposal to the Mayor and Council was to dig the pipe trench across the river and through the banks on both sides by means of a double-drum hoist on one side of the river and a cable which would pass through pulleys on the other side, using a slip scraper attached to the cable. Dirt from the bank excavation would be piled along the sides of the trench. That from the stream bed would be wasted, as far as possible, into the water and carried down stream. When the trench was as deep as desired, the pipe, which had previously been jointed up on the ice along the side of the trench, would be lowered to position and covered with concrete, and connected at each end, 20 ft. back from the river, to pipe which had been laid previously, before the ground had frozen.

This theory brought much criticism and protest from fellows who had laid gasoline lines and natural gas lines across the river and were equipped with pumps of large capacity and hundreds of dollars in sheathing and bracing materials, and would like to contract to lay it. The poison injected by these outsiders was not enough, however, to make the Council lose faith in the simple method I proposed, even though we could find no place where it had been tried before, and I was directed to go ahead with the work as planned.

I borrowed a double-drum hoist and bought 700 feet of ⅜" wire hoisting rope, equipped this with a slip scraper borrowed from the street department, and began excavating in the banks. The frost was just commencing to enter the ground, and as we piled our scrapings from the banks the dirt froze; the banks froze also, and the danger of caving was thus practically cut to nothing.

By the time we had the banks cut out 20 feet on each side, the river was frozen over and this allowed us to couple our pipe on the ice. We used steel pipe coupled, and welded the coupling with a portable electric welder. Next we painted it with a high grade iron preserver, then wrapped with burlap, painted again, and wrapped and painted it the second time. To each end of the straight pipe we coupled a 45° cast iron ell and set into these ells pieces of straight pipe long enough to extend 4 or 5 feet above low water when the pipe was in place. We then fastened sighters at three points on pipe line, one in center and one at each quarter point of the river, made by fastening 1½"x¼" strap irons around the pipe with one straight end extending at right angle to the pipe and so set as to rise vertically about 2 feet above low water when the pipe was in position. This was done so we could see exactly how our pipe was lying on the bottom after we had submerged it.

When we had our pipe thus prepared, we sawed a path through the ice and, using the slip scraper, dug out the sand to a depth of 5 feet at the center line, taking out sand until the line of natural repose was reached. The slip seemed to cross the river in a level line and, measuring from the ice to the bottom of the trench, we found it apparently level.

Next we slipped timbers, resting on the ice, under the pipe and across the open trench, attached chain hoists to the ells on the ends, moved the pipe to position over the trench and prepared to lower away. When we pulled out these timbers the pipe settled to a point about 15 inches below the surface, where it floated in equilibrium. Instead of buying extra weights to sink the pipe, we dipped water into it until it contained about 2,500 pounds of water, the pipe being below surface far enough not to freeze. The pipe settled evenly and when it rested on the bottom our indicators showed that there was not over two inches of variation across the stream.

We then filled 70 cement sacks with concrete mixed dry, and dropped them onto the pipe at close intervals across the stream. Next we made an "elephant trunk" of galvanized iron and, with the snout reaching to the pipe on the bottom of the river, poured dry mixed con-

Ice on river and trench in west bank.

Pipe rising in trench on east bank.

crete over and around the pipe until it reached a depth of 8″ above the top of the pipe and extended to the sides of the trench, where it was about 4″ lower than in the center. We thus had the pipe encased in concrete, and a dam across the river which had both an up-stream and down-stream slope which should deflect and widen any small channel cut that the river might later make and keep it from undermining our pipe line. After concreting over the pipe, we did no more about back-filling the trench, but it filled in gradually and today, almost a year later, the place could not be found by anyone not familiar with the work. The river has been at a very high and very low stage several times since the work was completed and nothing has happened to the pipe line or dam.

My theory was that with the water moving about one foot deep for a width of 90 feet, the trench dug would be, as in a lake, "still water." It worked out perfectly. We spent nothing for sheathing, pumping, or the things that ordinarily cost the most on this kind of work; and we did what men experienced in laying pipe lines across streams said could not be done, and did it with only a fraction of the cost, in labor, equipment and materials, of the regular methods.

Minor economies like this play an important part in making a city business like ours pay or lose. We are making it pay. On November 1 of this year our city will be free of all indebtedness, and this without the revenue of a municipal light or gas plant. We have budgeted for the last twelve years, and lived within the budgets. All cities can—if they will.

High Cost of Constructing Culvert with Unskilled Labor

By E. L. COOPER

County Engineer, Fleming County, Kentucky

THE Road Department of Fleming County, Ky., took the opportunity this year to carefully analyze the cost of using hand labor to the greatest extent possible, on a WPA job, and compare it with the cost of doing similar work by ordinary methods. This job was done in connection with relocating three miles of road to avoid crossing a creek several times, and involved crossing a deep ravine, the grade of the road being 24 feet above the solid stream bed and a concrete culvert being built to carry the stream.

This was a WPA project using relief labor. It was impossible to find skilled workmen among such labor in that locality, so I assigned to the project one first-class carpenter and two trucks on the county payroll, together with 38 WPA laborers. The lumber used for forms was sawed at local sawmills and was hand dressed on the job. The forms were built, and the concrete was mixed, poured and finished, all by WPA laborers.

This job passed the inspection of the WPA engineers without a single criticism—a very rare happening—but demonstrated how terribly expensive it is to try to work unskilled labor on jobs requiring skilled. Even though the government paid for the labor, the cost to the county was much greater than if it had employed at its own cost a half-dozen able bodied skilled men to install this culvert. The loss in form material and of the mixed concrete and the extra time spent on the job made it cost three times what it should have.

Close attention was given to the cost items on this job, to determine whether it is cheaper to pour concrete by men or by machinery, to use skilled or unskilled labor, and to buy dressed shiplap form material or obtain lumber in the rough and dress it by WPA labor. The analysis showed that machinery always pays. Convinced of which, we used a ⅜ yard shovel to fill the trucks for filling over the culvert, rather than have the project held up by filling them by hand.

As a further result of that experience, we have concentrated our WPA labor to the quarry pit, where we can use a large number of men to good advantage and continue to employ in relief labor those who are really in need of it. Also we have made concrete pipe in forms from the metal sheets of discarded truck beds, reinforced with wagon tires rolled to almost a perfect circle, the forms being so spaced that the wall of the pipe would be ½ inch thicker than called for by the State specifications, to allow for possible irregularities in thickness and insure obtaining sufficient thickness at the thinest places. With these forms, several hundred feet of pipe has been made and installed with WPA labor at a very low cost to the county.

Pouring 6x6x70-foot concrete box. WPA labor using three mixing boards.

Ocean Outfall Sewer Construction By The City Of Oxnard

E. O. IMUS
City Engineer of Oxnard, California

IN 1935, the City of Oxnard, California, was disposing of a low-grade septic tank effluent through a 16-inch outfall sewer which extended from the city south some three miles to within 900 feet of the ocean tide lands at the foot of Fourth street in the town of Hueneme. At this point it turned southeast from the town and continued down the tide lands for a distance of some 2,000 feet, then southwest 900 feet to the beach, where a 16-inch cast iron outfall extending 200 feet beyond mean tide had been constructed in 1926.

E. O. Imus

The 2,000 feet of the sewer running parallel to the beach was 14″ diameter, constructed in 1905 of redwood staves made from 1½″ x 4″ lumber tongue and groove and banded with No. 2 galvanized iron rods spaced 4 inches on centers. This wooden stave line became badly tuberculated, reducing its capacity and causing the sewage to back up in the pipe, resulting in breaks and constant leakage.

In the later part of 1935 the city completed the construction of a new and unusually successful trickling filter plant with full chlorination, and decided to abandon the wooden stave section and relay the outfall directly out Fourth street of Hueneme into the ocean. This point on the beach is used very little for bathing, as there are several citrus packing plants which discharge their drainage into the ocean, and a little farther down the beach is the outfall of the American Crystal Sugar Company, operating one of the largest refineries in the State. The proper bathing beaches are still farther up the coast and outside of any influence of the sewer outfall or drainage from the industrial plants. Request to the State Bureau of Sanitary Engineering for permission to make this change was granted, as was also an application for a work project filed with the WPA to furnish all labor, the city to furnish one foreman, pipe layer, shovel operator and engineer.

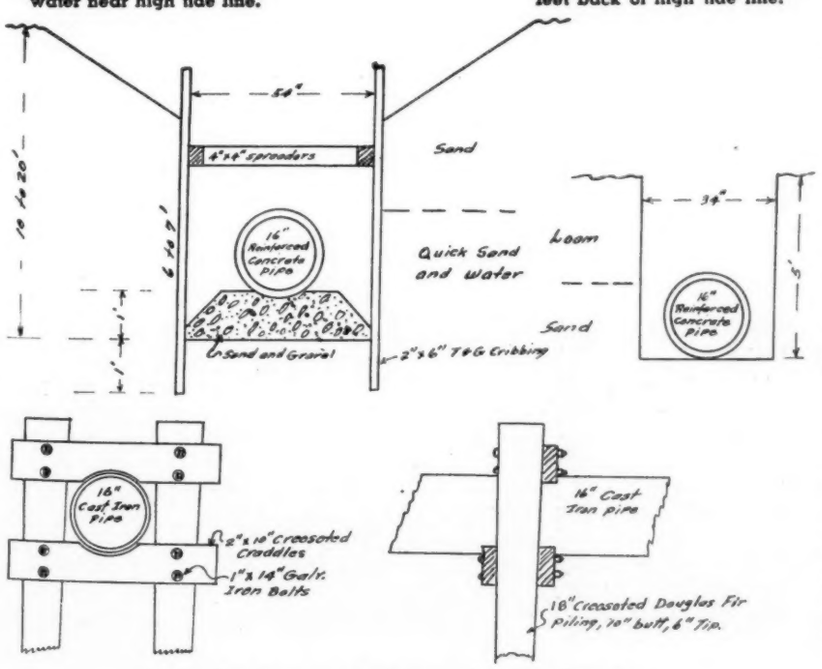
The work project was first started with the manufacturing of 1,480 feet of 16-inch reinforced concrete pipe, at the yards of the United Concrete Pipe and Construction Company located at Saticoy. The city rented the pipe rings, forms, tamps and equipment necessary for the manufacturing of the pipe and the WPA furnished the labor and a portion of the material. The pipe materials and cured samples were constantly checked and found satisfactory. The pipe making progressed at the rate of 250 to 260 feet per day.

Trenching was started 1,530 feet back of high tide line with a trench depth of 5 feet. The trench was dry at this point and the pipe was laid with a grade of six-tenths per cent. For the first 600 feet 2″ x 4″ trench spreaders, spaced 10 feet apart, were used to hold the banks. Then quicksand and water were encountered in sufficient quantities to necessitate pumping, supporting the pipe and trench walls and using additional materials. At this point, where the trench had a depth of 6 feet, it was widened from 34 inches to 54 inches to permit solid cribbing and material to support the pipe in the quicksand.

Cribbing was started with 1″ x 3″ ship-lap and 2″ x 4″ spreaders, which was continued until heavy top sand and a depth of 7 feet were reached, when we changed to 2″ x 6″ tongue - and - groove cribbing with 4″ x 4″ spreaders. Here the trench was excavated one foot below normal grade and filled to grade with sand and gravel, leaving a "V" shaped drain about 8 inches

Construction in quicksand and water near high tide line.

Normal construction started 1,530 feet back of high tide line.



18" Cast Iron Pipe
2"x10" Creosoted Cradles
1"x14" Galv. Iron Bolts
16" Cast Iron pipe
18" Creosoted Douglas Fir Piling, 10" butt, 6" Tip.

End and side views of pile bents for supporting pipe

deep at the side of the pipe against the cribbing for the water to drain through. The sand and gravel was lightly tamped on the top to assure a firm bed for the pipe, and 4 x 4 x 3 foot sumps were constructed in the bottom of the trench at 150-foot intervals where all water from the side drains concentrated and was removed with a 4-inch portable suction pump.

This operation continued to within 300 feet of high tide line, where large sand-dunes were encountered and a gasoline shovel with drag-line equipment was used to remove the heavy top sand down to within 6 feet of the bottom of the trench and construct a large sand dyke at the outer end to prevent the waves washing into the trench at high tide.

Backfilling was placed as soon as the cement joints had received their initial set and no pipe was left uncovered over night as the backfilling crew started work two hours later than the pipe laying crew and continued work two hours later in the evenings. Three men in 8-hour shifts kept the pump going continuously.

Concrete pipe laying was stopped 50 foot back of high tide line and the shovel was taken down the beach to remove the old 16-inch cast iron ocean outfall. This was uncovered, working four-hour shifts at low tide, and each 12-foot length removed by the drag-line and then rolled up the packed, wet sand near the edge of the water by the workmen to the new location, where it was scraped, reconditioned and well painted both inside and outside with asphaltic-base coating.

Douglas fir, creosoted piles 18 feet long were then driven with pile driver equipment attached to the boom of the drag-line using a 2,300 lb. hammer. The piles were driven in pairs at 10-foot intervals and 4″ x 10″ creosoted redwood cradles were bolted to the piling with 1 inch by 14 inch galvanized bolts both above and below the pipe. The cast iron pipe supported by piling was laid at the rate of one 12-foot joint per day from 50 foot back of high tide to 200 feet beyond mean tide, the last 100 feet being constructed in four-hour shifts at low tide.

After the completion of the new line the sewage was turned into it and the old outfall abandoned.

Much favorable comment was given this project by the San Francisco office of the WPA, as it was the first difficult project of this nature ever attempted in this district with unskilled labor and raw materials, as the pipe was manufactured by the workmen as well as most of the equipment used. The operator of the shovel and pile driver and the pipe layer were the only skilled men employed. The engineering was taken care of by the City Department, through its regular force with no additional employees.

Town Increases Water Revenue By Serving Neighbor

A SCARCITY of water in one town and of waterworks income in another are being solved by the laying of a pipe line as a WPA project. Both communities are in Rhode Island. The town of Cumberland has a new waterworks system consisting of a pumping system, a large steel standpipe and a limited amount of distribution piping. The supply is more than ample, but the revenue has not been sufficient to pay the carrying charges. The village of Albion, just across the Blackstone river in the town of Lincoln, draws its supply from a reservior of such small capacity that the town has been threatened with water famine on two occasions. Both scarcities could be solved if Cumberland could sell its surplus supply to Albion.

Legislative action was taken to permit Cumberland to operate in the town of Lincoln. To do so, it was necessary to lay a main about 9000 feet long to connect the two systems, and a WPA project was set up for doing the work, which is now nearing completion.

The project called for laying 3600 feet of 8-inch pipe southerly from the end of the existing line in Mendon road, then crossing westerly under the highway, across private property to the river, under the river, two railroad tracks and a power canal, and up Albion's main street. Three hydrants were installed along Mendon road and a connection for a mill at the side of the river.

The road contained a two-lane concrete pavement and the pipe was laid in the east shoulder, where the trench was thickly spotted with boulders, some of which required blasting. At the south end where the pipeline crossed under the concrete highway by tunnel, ledge was encountered. The excavation for the trench running westerly from Mendon road across private property to the river was very difficult because of the presence of ledge and boulders. A compressor and jackhammer drills were busy constantly for 12 weeks on this section. As soon as the necessary right-of-way for this crossing had been obtained, it was cleared of trees to provide access for materials and equipment. The country topography is rough and the pipe-line crosses hills and ravines. Because so much rock was encountered in the trench excavation, the pipe-line was laid on a bed of sand, which had to be brought to the trench and distributed, and care had to be taken on the backfill in order to keep rocks from contact with the pipe.

Where the pipe crosses the Blackstone river at the town line, there is normally about two feet of water, this water stage being maintained by a dam down-stream. Arrangements were made to do the work in the stream bed on week-ends when the water could be lowered at this dam and the work done practically "in the dry." In this section, across the river, the pipe was laid and backfilled in a trench about two feet deep. Pipe was also laid under the double railroad tracks. It had been planned to jack the pipe under these, but because of the uncertainty of soil conditions and because it was found possible to make arrangements with the Railroad Company, this work was put through by the open-trench method on a Sunday when no trains were in operation here.

The crossing of the power canal at the mill presented more difficulties than crossing the river. Here similar arrangements were made for drawing down the water at weekends, but the grade of the canal bottom is such that the water does not entirely drain off, with the result that pumping has to be carried on where the pipe is being laid at this crossing. Due to the ledge, the pipeline is not being sunk in the river bottom, but is laid on the ledge in a concrete bed, and is protected by concrete placed over it. After the pipe-line passes the power canal it runs up the Main street of Albion where no unusual difficulties are expected.

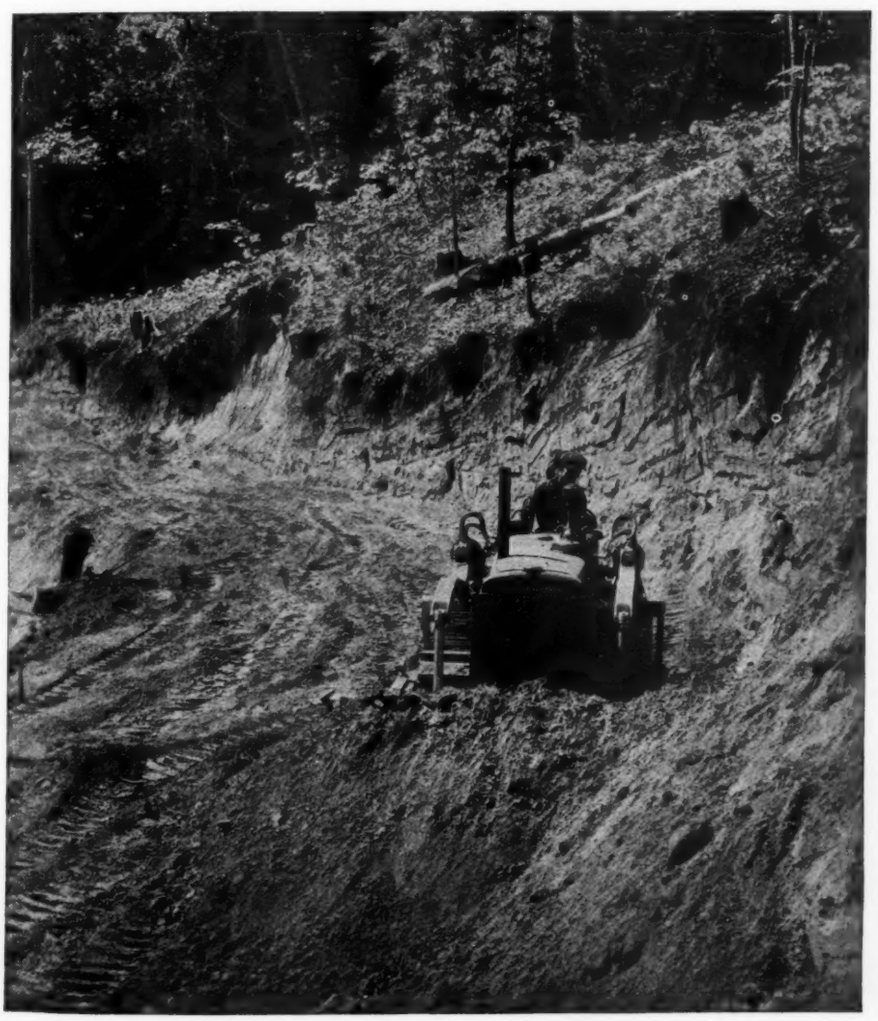
This project has been of a type particularly suited to WPA labor and upon its completion will result in an outstanding public improvement.

Building a Road at 4.37 Cents a Foot

Right: Making a road along a sidehill with tractor and bullgrader.

In opening a logging road in Northern Michigan, conditions resembled closely those that often confront the county or township engineers or supervisor, and therefore an account of the method of doing the work, and its cost, should be interesting. Similar problems in country highway work often occur in connection with opening new roads, with curvature elimination and with widening.

The first problem was to open up an 800-ft. long logging road connecting a tract of large timber with a highway over which the logs were to be hauled. This was sidehill country, rough-cleared, only. An International 40 diesel tractor equipped with a Bucyrus-Erie bullgrader was the only equipment used. The bullgrader is a special type of bulldozer in which the blade can be angled to either side, or raised and lowered.

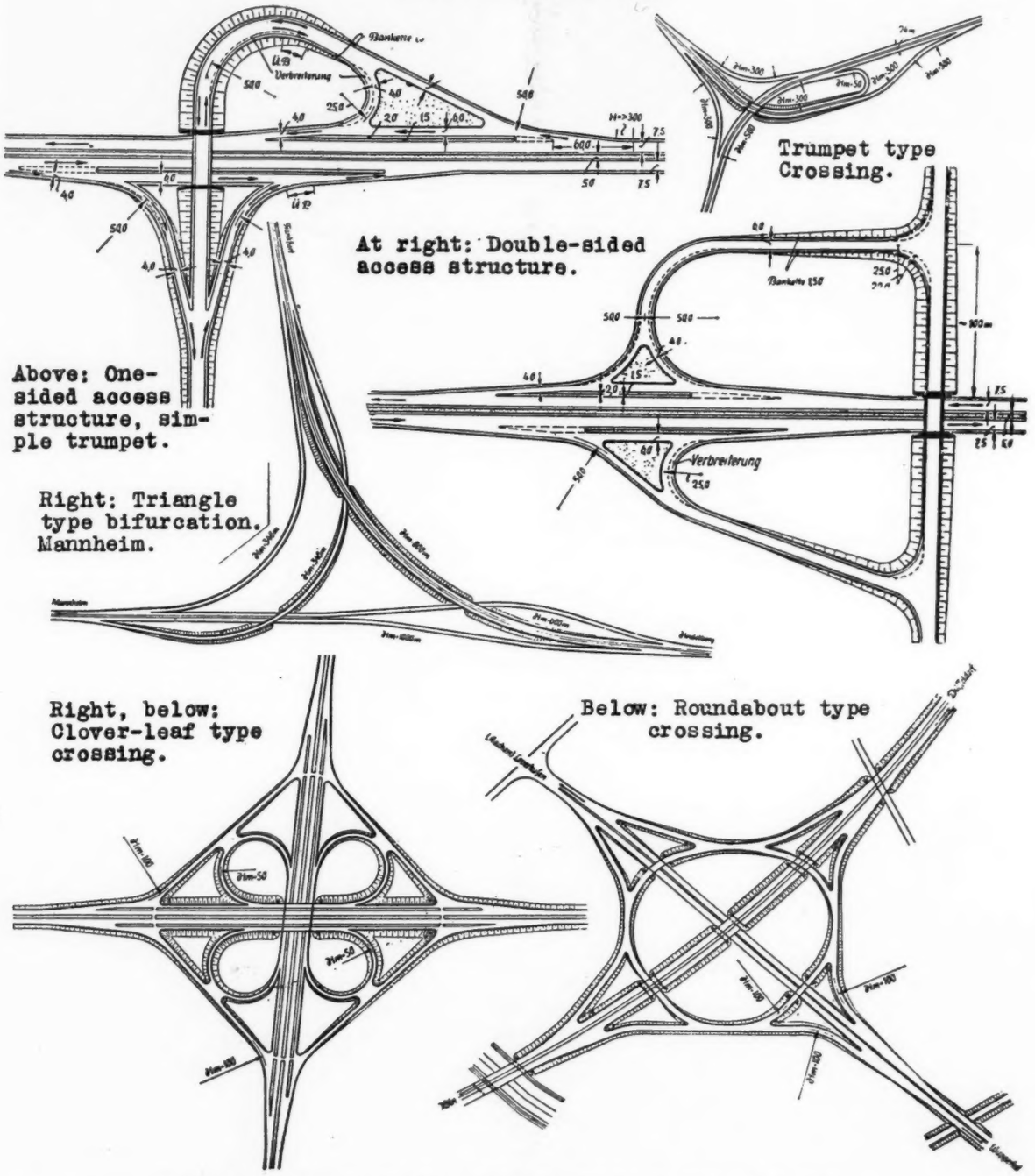


With this outfit, the 800-ft. section of road was completed in 20 hours of work. The total cost for fuel, oil, wages, depreciation and interest was $35, or 4.37 cents per foot. A total of 1,741 cu. yds. of dirt were moved at a cost of about 2 cents a yard. The blade was set at an angle with the tractor, cutting away the bank at one side, removing stones and stumps (also some trees) and pushing everything over the edge, leaving a broad roadway for the motor trucks to haul out the logs.

The Trac Tractor and bullgrader were used thereafter on other construction and has since built some 18 miles of roads. Cost data on all this work is not available, but fuel consumption has averaged 15 gallons per 8-hour shift.

This 800-ft. logging road was built in 20 hours.

Samples of German Grade Crossing Structures


Trumpet type Crossing.
At right: Double-sided access structure.
Above: One-sided access structure, simple trumpet.
Right: Triangle type bifurcation. Mannheim.
Right, below: Clover-leaf type crossing.
Below: Roundabout type crossing.

Some German grade crossing eliminators, as illustrated in "Highways and Bridges"

Purchase of Materials for Federal Project Without Advertising

Purchases of materials and equipment for a federal works project in connection with the construction of a sewer in the city of Lowell, Mass., were made by the CWA administrator for the city in 1933 without advertising for bids. The federal statute requires that purchases for government departments must be made by advertising for bids "when the public exigencies do not require the immediate delivery of the articles, or performance of the service." The Federal District Court for Massachusetts held, in an action for the purchase price, Good Roads Machinery Co. of New England v. United States, 19 F. Supp. 652, that the purchases were made under a public exigency requiring immediate delivery, eliminating the necessity for competitive bidding and that the plaintiff's claim should have been allowed. Plaintiff's claim was not barred because of a regulation requiring all purchases of materials to be under control of the State CWA, where the local official had not been apprised of the regulation until after the contracts were executed.

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Look into these tires without delay. Have the Goodyear dealer nearest you show you all three—help you select the right one for your work.

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CUT OPERATING COSTS STILL MORE WITH GOODYEAR BATTERIES, RIMS, FAN BELTS, RADIATOR HOSE

Turn to pages 67-69 for descriptions of helpful booklets and catalogs.

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

The Water Wheel

Snow surveying by photography is being tried out on Denver's water shed. Photographs taken at regular intervals from the same point and showing the same panorama of mountain peaks and snow-filled gulleys; the larger each patch of white, the deeper the snow in the gulley. Run-off gaugings less rainfall give snow runoff, and this is compared with photographed snow areas with a view to learning the relation between them. The previously used method of snow gauging gives depths at readily accessible points only, but a large part of the snow reserve accumulates in inaccessible gulleys.[E39]

An emergency spillway is being built in connection with a reservoir for the Birmingham industrial water supply, which covers more than 1600 acres and is formed by a rock-fill dam 195 ft. maximum height and 1100 ft. long. The diversion tunnel will serve as a spillway, the water entering through a shaft, designed to take care of a probable maximum flood; but to provide for a so-called "500-year flood," an emergency spillway is provided, consisting of a concrete weir with a crest 4 ft. below normal level, but with a 10-ft. earth fill above it. Should the water in the reservoir rise 6 ft. above the regular spillway it would overtop this earth bank and wash it away, and the concrete weir would serve to lower the reservoir, flowing at first under a 10-ft. head.[X1]

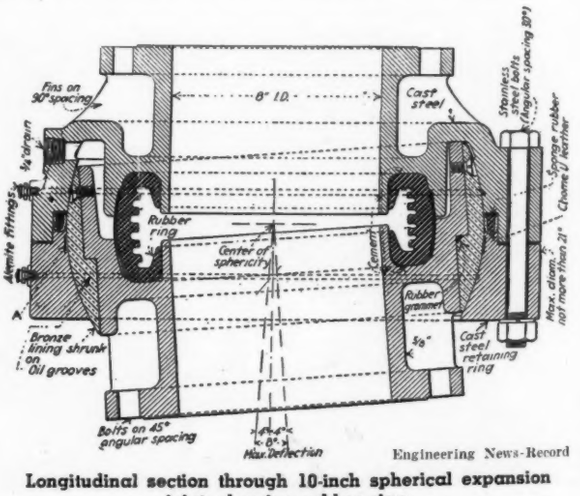
Expansion of the main which takes water from San Francisco to Yerba Buena island (for the International Exposition) over 2.5 miles of bridge called for special joints. The pipe is 10″, pressure 50 to 150 lbs. Temperature movement up to 30″ is expected at the end of each span, and more or less cross motion as well. To permit such movement in the pipe, which is attached to the bridge, a special construction was designed. The pipe at this point is offset at right angles 24′, coming back to the original line 24′ further, and a flexible joint is provided at each end of one of the offset legs. No spherical joint was found on the market sufficiently rugged and leakproof, and one was designed (using 8″ with reducers) for the purpose. The male spherical surface was formed with a bronze lining shrunk on the spigot end, while the bell carries a cast steel retaining ring. The joint is made watertight by a rubber ring whose inner sides are reinforced with canvas and whose outer face is backed with a bronze band to prevent pinching the rubber. Any leaking which might occur will be removed through a ¾ in. drain pipe. Twenty-four such joints will be used.[E43]

Evaporation from covered reservoirs with limited ventilation was not reduced enough (at La Verne, Calif.) to make covering worth the cost unless for protection of purity. A 200,000 gal. reservoir, circular, 60′ diameter, was covered with a circular frame wall 5.5 ft. high, the upper 14″ screened, and a black tar paper sloping roof. During an 11-month test the difference between evaporation from the tank and from an uncovered pan was 29″, but this is reduced to 13.7″ if the coefficient of 0.70 be applied to reduce it to reservoir value.[E44]

Unaccounted for water of only 4.9% is claimed for Singapore in 1936 by the municipal water engineer. He states that "The water was metered by venturi meters where it passed into the distribution system from two purification plants; at one of these plants the venturi meter checked the slip on triple ram pumps, and the figures re. slip are good. If the total amount of water so supplied to the distribution system, 93.52% was registered on consumers' meters; 1.58% is estimated to have been used by the fire brigade (fire hydrants are not metered) and in flushing mains, etc. If we assume that 3% of the balance was under-registration of consumers' meters, the remainder represents a leakage of less than 80 gallons per inch-mile per day on the distribution system—which is not a bad figure." In fact, he thinks that it is probably a world's record.[D12]

Compound meters are being replaced by batteries of smaller meters in Grand Rapids, Mich.; four 2″ meters in place of one 4″, for example, with generally satisfactory results. Costs of installation and maintenance are less, operating difficulties are adjusted more readily, the troublesome bypass is eliminated, and much higher readings and income are obtained. Twenty installations so changed increased their monthly registration from a total of 2,016,043 to 4,728,944 cu. ft., yielding $22,872 more per year.[F96]

Embankment materials for Quabbin dike (Boston, Mass., water supply) were obtained from borrow pits selected after studying the soil in all easily accessible areas by means of 2.5″ bore holes and hand-dug pits 6′ to 10′ deep, the former about 400′ apart. Earth samples were tested for grain size, permeability and porosi-



Longitudinal section through 10-inch spherical expansion joint, showing rubber ring.

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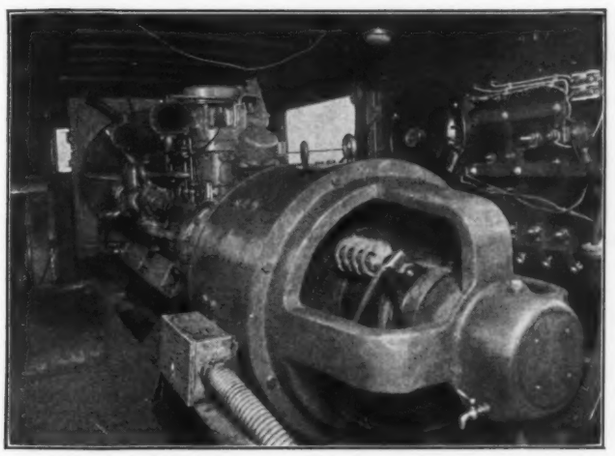

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ty in a soil laboratory. Promising areas were further investigated by four shovel cuts into the hillside giving a face 20′ to 30′ high; which cuts cost an average of $1200 each, but as exhibits to prospective bidders paid for themselves many times over by minimizing uncertainty concerning materials and excavating conditions. Soils selected were subjected to a sluicing test in a bin 15′ wide by 40′ long, in which actual working conditions were simulated, and qualitative and quantitative properties were thus studied and the material most suitable for each part of the embankment determined. During construction, core samples were taken at frequent intervals and analyzed for moisture content, which should be a determining factor in regulating rate at which the embankment is raised. A formula for computing rate of consolidation is given.[K7]

Licensing waterworks employes exists in some form in California, Georgia, Michigan, New Jersey, New York, Ohio, South Carolina, Texas and West Virginia. Combination of "short schools" with it seems desirable, since the low pay of operators makes it difficult to get college-trained men for small places. Most state health departments can establish licensing under their present powers if they wish, but generally prefer a specific mandatory law. To do the former, examine the public health laws of the State in question for some clause which permits the health department to issue regulations governing waterworks operators, and get the opinion of the Attorney General on the legality of setting up licensing regulations under this clause; first selling the idea to the waterworks employees, the public and the health department. The A. W. W. A. has a committee which furnishes aid to states in this matter.[A129]

Pensioning waterworks employes of municipalities is not included in the provisions of the Federal "Social Security Act", but must be done by municipalities through State or municipal legislation.[A134] Pensioning would raise the morale, increase their effectiveness, and decrease labor turnover.[A135]

A **salt water supply** is piped to homes in Charlotte Amalie, Virgin Islands, for use in flushing toilets. It is also used for fire fighting. Fresh water is too scarce to use for this purpose. The salt water causes constant rust corrosion, but new pipe, both water and sewer, will be of cast iron lined with cement.[F99]

20° bacteria in filter effluent at Salem - Beverly were found to be due to slime on the filter walls, fairly thick in many places. This could not be removed by strong doses of hypochlorite or by copper sulphate: but when the wall surface above the sand was scrubbed with stiff brushes, followed by heavy hypochlorite treatment and several filter washings at increased flow, the trouble disappeared, and there have been neither further slime deposits nor trouble from bacteria.[B16]

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A Digest of the Sewerage Literature of the month giving the main features of all the important articles published.

The Digestion Tank

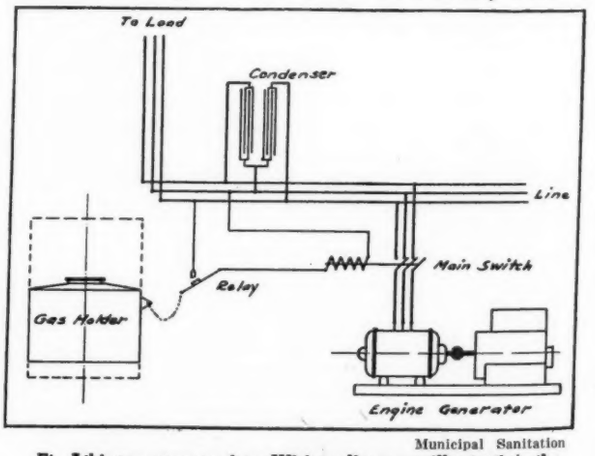
Scum spraying of a digestion tank at North Adams, Mass., when done daily, prevented scum formation which had reached a depth of 12 ft. The digestion tank, 35 ft. diameter by 21.5 ft. side wall depth, with fixed concrete roof, gives 1 cu. ft. per capita capacity, and there is a sludge storage tank of similar capacity. Placed in operation in Sept. 1935, without seeding, temperature of 85° maintained, scum had formed to 12-ft. depth by December, 23% solids at the top. Hosing helped temporarily; lime, but little. No sludge was added during March and April, but when added in May, scum formed again despite favorable pH, temperature and gassification, clogging the overflow pipe. Scum spray piping was installed and the surface sprayed with warm supernatant liquor for about an hour each day. This is now regular practice and there have been no evidences of scum formation and the tank has operated satisfactorily. [C53]

Sludge gas has been in use for three years at Ft. Atkinson, Wis., furnishing most of the power and heat for the sewage plant, including pumping against 20 ft. head. At the price charged for gas by the Public Service, 1.76 cts. per kwh, the sewage gas used for power last year was worth $1,740, or 27 cts. per capita (but some of the gas comes from cannery wastes). For a digester gas power installation to be practical, the arrangement should be simple, automatic in operation, utilizing completely and efficiently all the gas generated, and all the exhaust heat from the engines should be available for heating digester and buildings. At this plant the generator is a simple induction motor which, connected across the line of the public service, starts the engine. As this approaches synchronous speed the ignition becomes effective and the engine delivers power to the generator until it operates above the synchronous speed sufficiently to deliver to the line exactly the electrical energy which corresponds to the power developed by the engine. The switch which connects the generator with the line is operated by the rising and falling of the gas holder bell. The wiring diagram is shown.[H31]

Garbage digestion mixed with sewage is provided for in a plant at Lansing, Mich., to be completed early in 1938. (Believed to be the first large city to adopt this method.) The garbage is being fed to hogs; averages 0.5 lb. per capita per day from about 70,000 population. The new plant is designed to handle the sewage and garbage from a population of 100,000. After passing through detritor and comminutors, the sewage is aerated to separate the grease, and settled in tanks enclosed in a building made entirely of non-rusting materials—concrete roof and brick walls with glass blocks in place of windows, ventilated to a 100 ft. chimney. The settled sewage is activated, and the sludge digested, first being partly dewatered in a De Laval sludge centrifuge. The garbage does not enter the sewage, but is delivered to the plant in cans, ground in hammermill grinders, and discharged into ejectors which deliver it directly to the digestors with about 75% moisture. The digested sludge will be dewatered on Oliver vacuum filters and then dried or burned in a rotary Decarie incinerator.[H30]

If industrial wastes are added to sewage, successful operation of a treatment involves controlling (1) The character of the sewage that comes to the plant. (2) The character of the sewage or sludge as it is introduced into the various treatment devices. (3) The temperature at which the sludge is digested. (4) The pH in all biological processes. (5) The seeding with proper type and amount of organisms in biological devices. (6) The balance between oxygen supply and oxygen utilization in aerobic processes. (7) The distribution of treatment load between the various processes. The first is the most important and most difficult. In biological treatment, the sewage should be as uniform in composition and quantity as possible, free from sudden dumping of the more deleterious wastes; not highly loaded with suspended matter; free of excess acidity or alkalinity and not high in content of chemicals that precipitate on neutralization or oxidation; practically free of antiseptic materials and poisonous metals; low in content of the carbohydrates, sugar, starch and cellulose; and low in oil and grease content. Discharge of industrial wastes in proportion to the flow of domestic sewage is very important. Preliminary screening of wastes by the industry itself is generally performed satisfactorily, but they do not always give proper attention to preliminary settling, and better results might be obtained if money spent for these were used to increase the settling and sludge disposal facilities at the municipal plant. Of all the common industrial wastes the most deterimental to biological processes are the carbohydrates or fermenting wastes—milk, alcohol, brewery, starch and canning wastes.[C58]

Sludge disposal at Chicago's West Side works in 1936 was chiefly by dumping air-dried sludge. This was removed from the 27.3 acres of beds in 30 cu. yd. dump cars to a low area 3 miles away, about 720 car loads being so dumped. In addition, 280 cars were dumped at the plant for use in landscaping around it and for the convenience of small users, 150 cars were spotted on track in the plant for convenience of large trucks, 35 cars were shipped to Michigan orchards, 7 cars were trucked to a nursery and 8 to the grounds of a sanatorium. No charge is made for it. The Sanitary District



Municipal Sanitation

Ft. Atkinson gas engine. Wiring diagram, illustrating the simplicity of the electrical connections.

is experimenting to determine whether a top soil suitable for grass and shrubbery can be made by properly mixing clay and dried sludge. The sludge runs about 42% moisture and 2% nitrogen. Sludge is left on the beds from November to April, chiefly to protect the sand on the beds from drifting.[C61]

Winery wastes from sweet wine manufacture include pomace (seeds, skins, stems, etc.), lees (sludge from settling tanks), wash water, and still slops (wine used as still material minus the alcohol). Pomace is usually disposed of on land. Lees have a population equivalent of about 35 per ton of grapes handled, wash water 5 persons, and still slops 225 persons. The mixed wastes are carbonaceous in character and in river water form an excellent medium for the growth of various types of fungus. Some grab samples of wastes averaged 6800 ppm of oxygen consumed, 3500 ppm of 5-day B.O.D., 8,000 ppm of total solids, and a pH of 4.0. Their presence in the Mokelumne river was deleterious to fish, partly because the fungus growth and sediment irritated their gills, partly by the reduction of dissolved oxygen in the river.[C54]

Tomato skins from a cannery at Palo Alto, Calif., formed a dense mat 2 to 4 ft. thick on the surface of a fixed-cover sludge digester and do not digest, being still there after two years. They clogged the centrifugal sewage pumps, working their way between the casing and the runner and rolling up into tight wads, it being necessary to remove the upper half of the pump casing at intervals to remove them.[C55]

Sludge value as fertilizer has been calculated by a Peoria, Ill., farmer as $4.41 per ton of dry solids or $1.24 per cu. yd. Loading and hauling the sludge costs him 17 cts. a cu. yd. He spreads 15 tons of dry solids per acre in the fall, leaves it all winter, harrows lightly in February and plants spinach; also planting spinach on an adjoining acre without sludge. The fertilized acre yields 343 bu., the unfertilized 241 bu.; and the former matures 7 days earlier, bringing a price of 53 cts. while the later price is 40 cts., giving a net increased yield of $66.19 per acre. As drying the sludge for sale would cost $4 to $5 per ton of dry solids, it would not appear profitable to do so.[C60]

Trade waste digestion in combination with sewage sludge had varying effects depending on the waste. The wastes tested included tannery, rug, wool and blood wastes. Gas production was increased by smaller quantities of wastes, but retarded or slightly decreased with large quantities. Ripe sludge will tolerate 15 to 20% organic waste when added intermittently, but 20 to 40% when the waste is received continuously, when digested mesophilically, and more when thermophilically. Under thermophilic conditions sludge is less sensitive to organic trade wastes than under mesophilic. All wastes caused increased hydrogen sulphide concentration in the gas, more under mesophilic than under thermophilic. Some of the wastes had a decided effect on the odor of ripe sludge—much more pronounced under thermophilic conditions. Blood gave a very offensive onion odor to mesophilic sludge, pig pen odor to thermophilic; wool and rug wastes gave a slight ammoniacal odor to thermophilic; tannery vat waste decreased the odor when it did not exceed 10%, but gave a strong ammoniacal odor when 50%. The drainability of sludge was adversely affected by the wastes, more so by the thermophilic.[C50]

Creosoted wood stave pipes have been used in a number of localities for sewers, in sizes from 12″ to 66″ or larger. Among the earliest were those used by New

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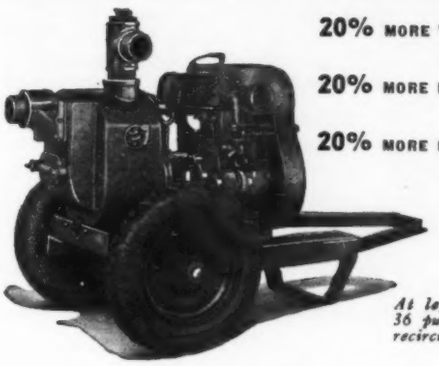

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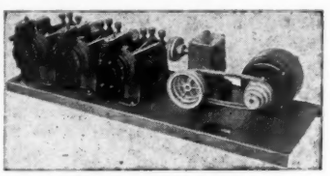

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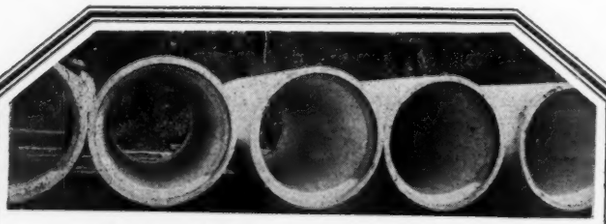

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18. Servicing Sewage Meters. By W. W. Glover. Pp. 85-86.
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7. *p.* Bulking of Sludge in the Activated Sludge Process. Rep't of Committee of A.P.H.A. Pp. 5-7.

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Industry Uses the Putnam Process

Trade Wastes, Sewage and Garbage Treated in a Plant Entirely Enclosed in a Single Building

By ROBERTA BLAIR*

THE Putnam process, which has been adopted for several municipal sewage treatment plants, which have been described in PUBLIC WORKS, is being employed for the treatment of industrial wastes also. The Campana Sales Company of Batavia, Ill., one of the largest manufacturers of cosmetics in this country, is now completing a plant using this process for treating its wastes. The company employs over 500 people and operates a cafeteria in conjunction with its plant, and the industrial wastes from the plant will be combined with the domestic sewage and garbage from the cafeteria, which combination will be treated in the sewage treatment plant.

The building in which they manufacture their products is designed along modernistic lines, constructed of terra cotta and glass blocks; and the treatment plant will be housed in an attractive building designed along similar lines, using face brick and glass blocks, with no windows. The building is 23 feet wide, 31 feet long and 25 feet high.

As the sewage enters the plant it passes through a comminutor which cuts the solids into pieces about one-eighth inch in diameter and returns them to the sewage, which then passes through a trough to a mixing tank. As it passes through the trough it is treated with lime and carbon, the purpose of which is to arrest putrefaction and adsorb contained gases, thus minimizing odors. Also the pH of the sewage is raised to 9.0. The sewage is thoroughly mixed in this tank for six minutes, propeller-type mixers being used. It leaves this tank at the bottom and enters the bottom of a second mixing tank, where it receives a dose of ferric chloride and is again mixed for six minutes and overflows to the clarifying tank, which is identical in construction with those used in the plant at St. Charles. (See PUBLIC WORKS for January, 1937.) This is of the vertical flow type, with a coagulating compartment, a sludge compartment and a compartment for the clarified liquor.

From this tank the clarified liquor passes over a weir to a trough which distributes it to rapid sand filters. The filters are constructed with an underdrain system of transite manifolds and laterals and Wagner blocks, which support 15 inches of gravel graded in four layers, which in turn support a layer of silica sand having an effective size of 0.6 mm and a uniformity coefficient of 1.6. The filters are provided with loss-of-head gauges and rate-of-flow and basin-level controls. They are designed to operate normally at the rate of 2 gpm per square foot. The filters rest on top of a concrete effluent well into which the filtered water falls, receiving, as it enters the well, a dose of chlorine of approximately 2 ppm. The overflow from this well passes out as the plant effluent. Water is drawn from this well for backwashing the filters, and the wash water is returned to the incoming sewage and recirculated through the plant.

The sludge from the clarifying tank is drawn off by hydrostatic pressure to a closed sludge tank. This tank is then made air-tight by closing valves in all pipe leading to it, and compressed air is introduced to the top of the tank, forcing the sludge through a pipe connected at the bottom and into a sludge press (made by R. D. Sperry Co. of Batavia, Ill.). Here the sludge is subjected to a pressure of 75 pounds per square inch. The air compressor is equipped with an automatic switch which cuts it in and out at predetermined pressures,

*Mr. Putnam had expected to write for us a description of this plant, but has been for some time and still is a hospital patient, and asked his secretary, Miss Blair, to substitute for him as author, and to her we are indebted for this article.

Building which encloses the treatment plant. That housing the industry is seen in the background.

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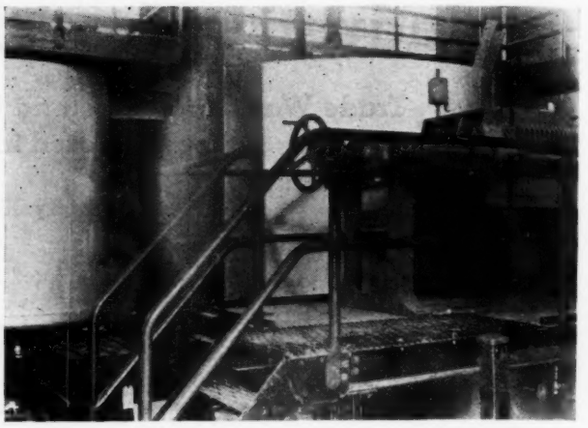


Part of the plant (tanks and filter press) under construction.

making it necessary only to start the compressor and the operation then becomes automatic. In fact, all units connected with the plant are automatic and are controlled by the flow of the sewage, and the attendance of an operator will be required for not more than three hours a day.

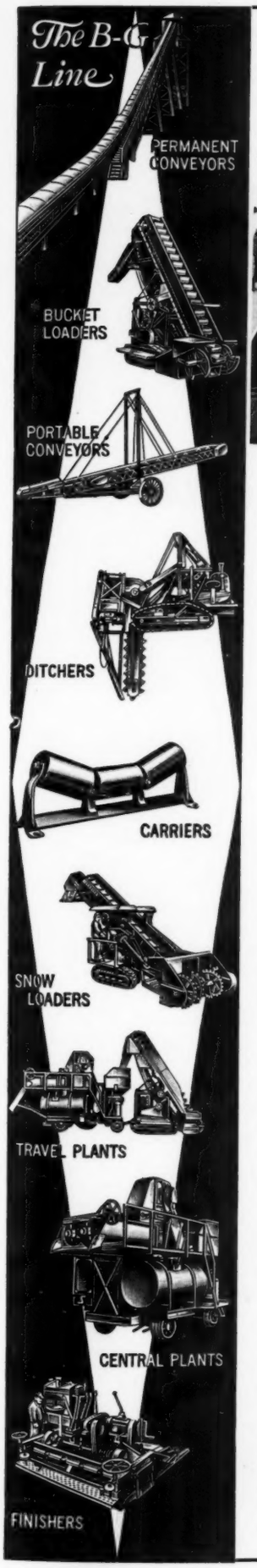
This is my description of the plant from seeing the drawings, inspecting the plant itself and from information gleaned through handling the correspondence concerning the plant.

Recent tests of this process in treating milk wastes and canning wastes has shown a reduction in suspended solids of 98% and in B.O.D. of 90%. The B.O.D. of wastes from a corn canning establishment was reduced 99.1%—from 1600 to 44 ppm.

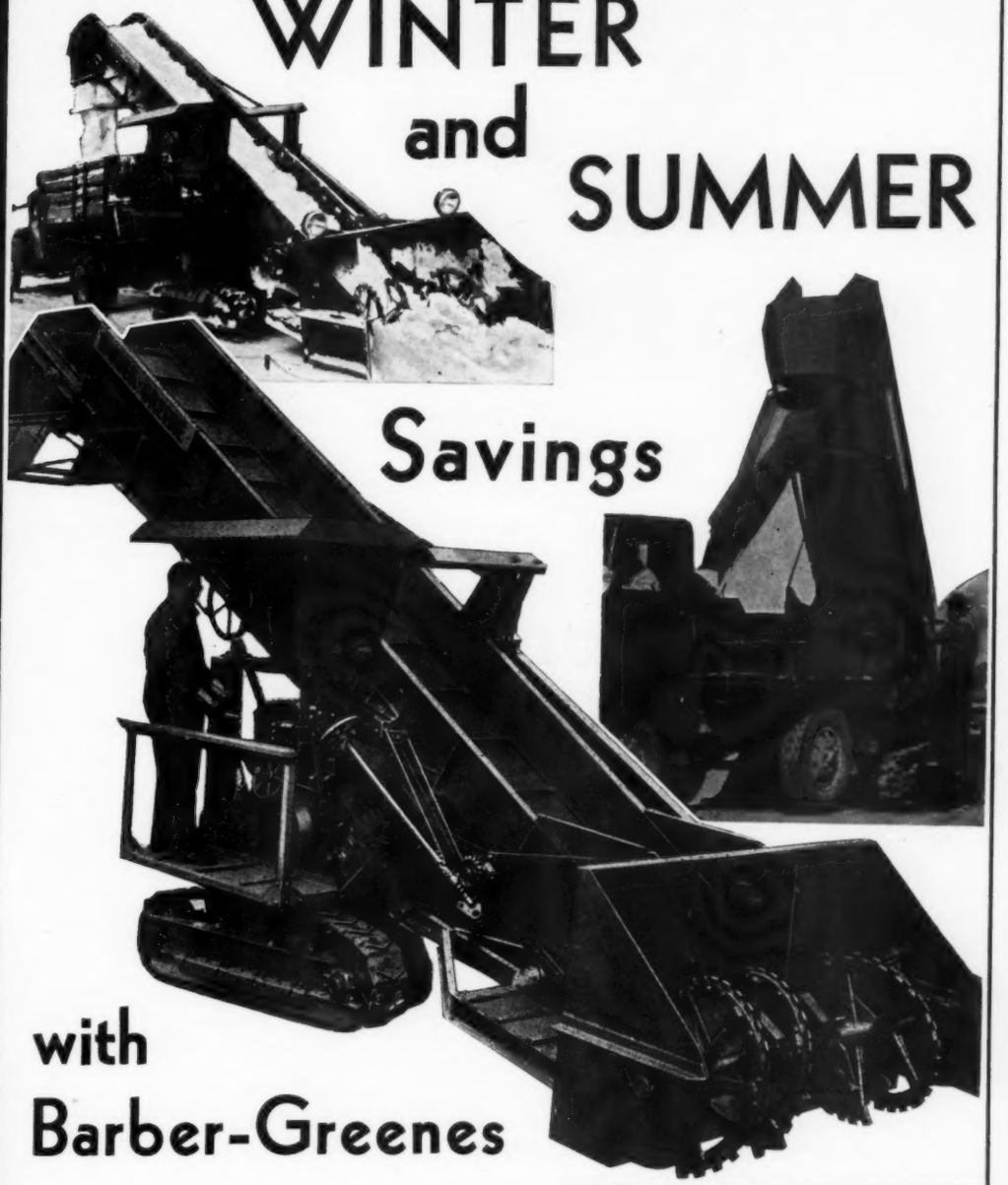
A Cubic Yard May Be 13½ Cubic Feet in Missouri

In an action by a subcontractor against the contractor for the construction of a post office building in Kansas City, Missouri, the sole question at issue was the amount due plaintiff for earth excavation under two contracts. If the excavation done was measured at 27 cubic feet per cubic yard plaintiff was entitled to $594.98 under one contract and $1,742.88 under the other. If it was measured at 13½ cubic feet per cubic yard he was entitled to double these figures. Curiously enough, the Federal District Court for western Missouri said, Hill v. Ring Const. Co., 19 F. Supp. 434, the only question in the case was whether a cubic yard is *a* cubic yard or is *two* cubic yards. A Missouri statute (section 14494 R. S. Mo. 1920) as interpreted by the Missouri Supreme Court (Webb-Kunze Const. Co. v. Gilsonite Const. Co., 281 Mo. 629, 220 S. W. 857) in effect provides that in making such excavation work (pier hole excavation) 13½ cubic feet is a cubic yard and in dealing with ordinary Missouri contracts to be performed in Missouri, the court said plaintiff's contention that he was entitled to double measurement would prevail.

The court also said no federal statute could be found defining "a cubic yard." But "there is, in a sense at least, a national common law—the old common law. At common law two added to two were always four and a cubic yard was a cubic yard. That is the law which governs contracts made and to be performed on territory (such as this post office site) subject to the exclusive jurisdiction of the United States." The court sustained the defendant's contention that the post office site was not in a manner of speaking in Missouri nor subject to its jurisdiction, Missouri having surrendered its jurisdiction when the site was acquired by the government.



WINTER and SUMMER Savings with Barber-Greenes



The 38-D is the Greatest Snow Loader ever built by Barber-Greene.

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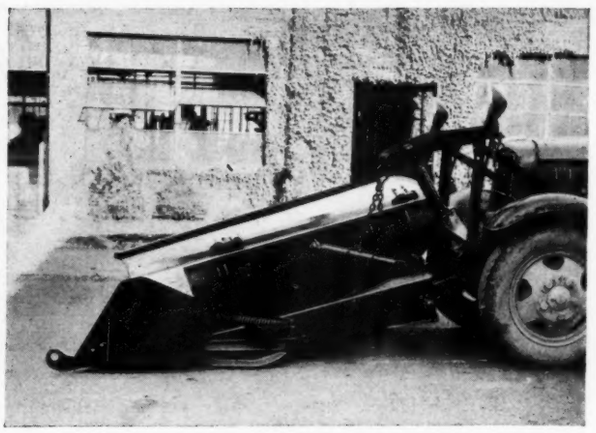
37-21

Turn to pages 67-69 for descriptions of helpful booklets and catalogs.

A Frink V Plow. This type of plow is suited for heavy work and rural roads.



Frink One-Way Plow for use with fast trucks for patrolling on improved roads.

Snow Control Equipment and Methods

SNOW plowing presents many varied problems, not only as regards depth of snow and mileage to be covered, but also in types of roads, which vary from the broad hard-surfaced main lines to the narrow rural roads which are often of dirt or gravel construction. For these varying conditions, several types of snow plows have been developed.

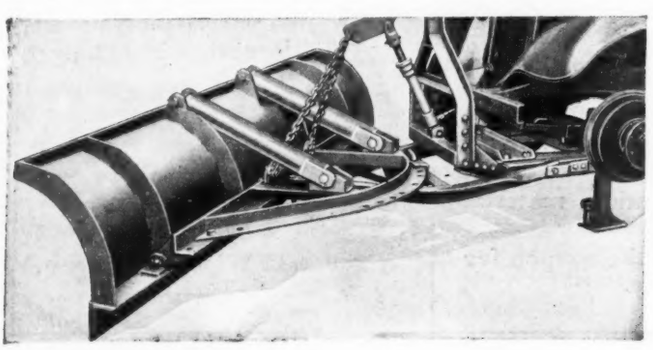
The three principal types for highway plowing (as compared to the plowing of city streets) are the blade plow, the V-type plow, and the rotary. These have rather distinct fields of use, which of necessity overlap each other. However, snow removal is always a matter of urgency — a fight against time—and all equipment has to be used in an emergency to clear the roads, and time, space, and economic and personnel factors do not permit that each piece of equipment be used only for the work that it is best fitted for.

Most counties, cities and States can, however, provide such equipment that, except in unusual storms, a balanced list is available for either light or heavy snowfalls, and for drift removal. Primarily this is because the cost of snow-removal equipment is not great. Blade and V-plows are relatively cheap; and the costlier trucks and tractors—the motive power—are available from regular highway construction and maintenance equipment, or can be rented.

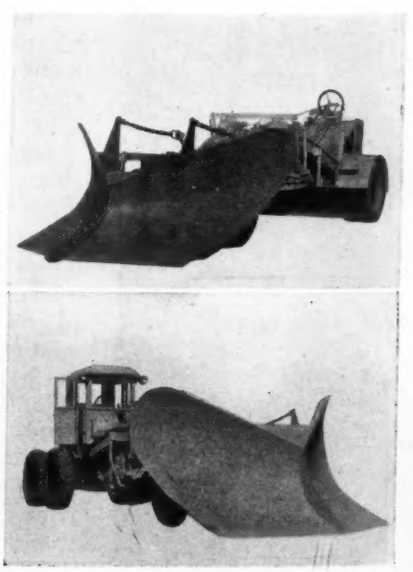
Blade Plows

Blade plows are of two types—"one-way" and reversible. The "one-way" type is tapered and curved to pick up and throw the snow clear of the road. It is normally operated at high speeds. The reversible type blade has less curvature and tends to push the snow; because it is designed to operate to either right or left, it cannot be tapered.

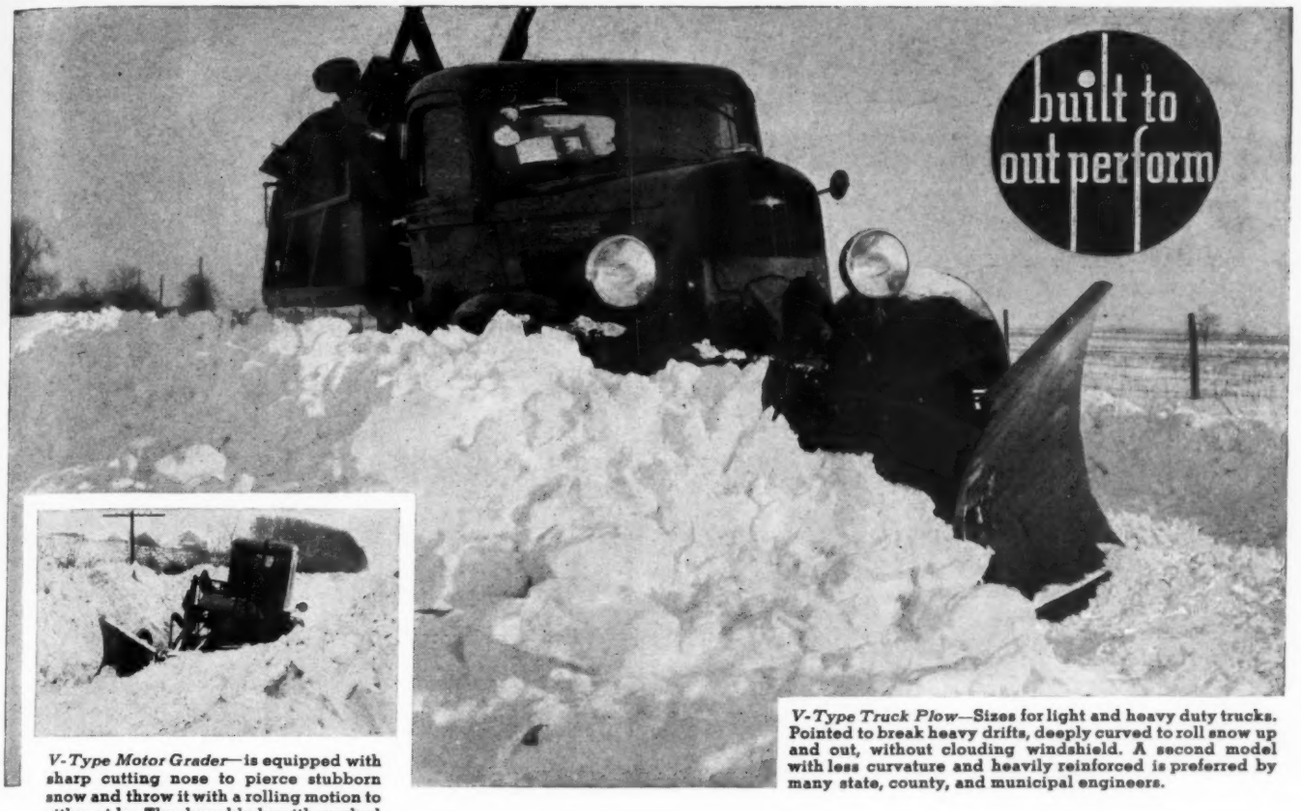
The "one-way" plow is used with fast trucks; it is designed to cut under the snow, raise it above the adjoining snow and spread it so as to avoid the formation of side banks, which encourage later drifting. The design of the blade should be such that the snow is not thrown into the truck radiator or windshield at any rate of speed, but aside and off the road. This type of plow is effective and most economical for use on snows not more than 12 inches deep except in the largest cities. In fact, it is practically standard patrol equipment for improved roads. Common practice is to start a fleet of such patrols shortly after the beginning of a storm and continue the work until the storm has stopped and all roads have been opened. Sargent says that such plows, under average conditions, can do over 90% of the plowing on improved highways,with average wind and snow conditions. The "one-way" plow cannot handle drifts or heavy snows.



Left: Austin - Western Reversible Plow for trucks, showing mounting.



Right: Galion V Plows for use with motor grader.



V-Type Truck Plow—Sizes for light and heavy duty trucks. Pointed to break heavy drifts, deeply curved to roll snow up and out, without clouding windshield. A second model with less curvature and heavily reinforced is preferred by many state, county, and municipal engineers.

V-Type Motor Grader—is equipped with sharp cutting nose to pierce stubborn snow and throw it with a rolling motion to either side. The deep blade with marked curvature displaces high snow in a hurry.

One-Way Type—Tapered and deeply curved to pick up, "spiral" and throw the snow. This plow can be worked at the highest operating speeds. Handles a large amount of snow quickly. Curvature prevents snow from clouding windshield or clogging radiator. Blades supplied with fixed angle, adjustable tilt, or with adjustable blade angle and fixed tilt.

Reversible Type—A straight blade, with less curvature, to push snow to one side or the other. It is ideal for use in heavy slush or where snow is comparatively shallow. Equipped with a circle, this blade can be set straight across truck or at any desired angle.

You'll soon be fighting SNOW again

CHECK NOW ON THE SPECIAL FEATURES IN A-W PLOWS

In only a short time snow will be blocking traffic. Be prepared to keep your highways clear at all times and eliminate the frantic calls from citizens who fear they will be cut off from medical aid and food supplies.

Buy your snow plows now! Avoid the uncertainties that come from placing late emergency orders.

Austin-Western offers a full line of Tapered One-Way, V Type, and Reversible Type Plows to be mounted on light or heavy trucks.

In all these types the plows are designed with the correct curvature to give complete snow removal with the minimum of power. Other Austin-Western features are the special design which permits the plow to be attached or removed from motive equipment in the shortest possible time. Push frames are designed to protect both the plow and the motor vehicle. Safety releases protect equipment from operating damage and break downs. Plows are lifted or lowered by hydraulic pump located within the truck cab.

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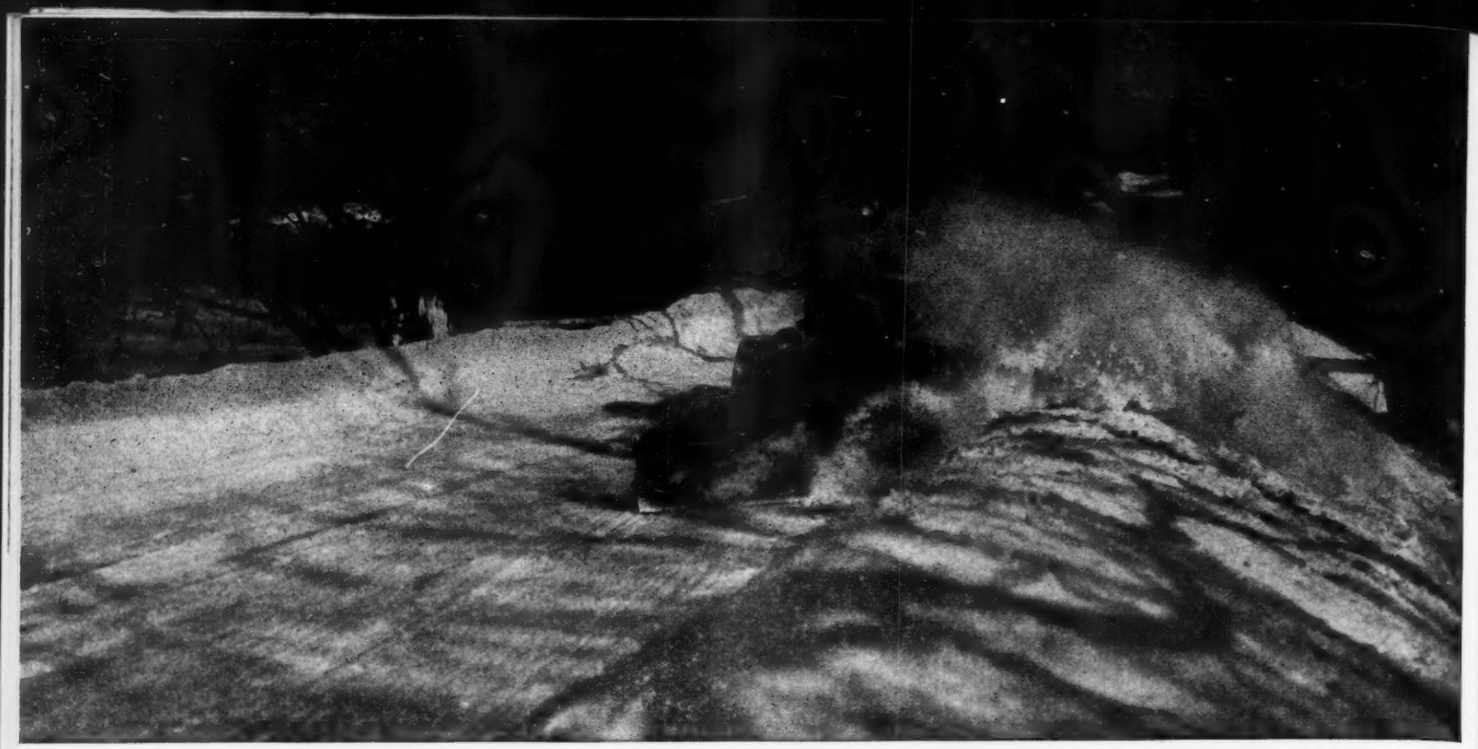
Turn to pages 67-69 for descriptions of helpful booklets and catalogs.



Speed Plows Are Necessary for Modern Snow Removal.

The reversible type of plow is used primarily to push the snow to one side or the other, as with heavy slush or with light snows. The bulldozer, described hereafter, can be used for the same work, and there are also special types of blades for this work. The reversible plow is primarily a low-speed unit.

One-Way Blades

The "one-way" blade plows are for medium snows on improved highways. They are made in all sizes for trucks of 1 ton capacity and larger. The reversible blade plows are primarily for city use, where the snow is to be pushed to one side, or to the center, of the street.

Frink makes five sizes of one-way "speed sno-plows." The 20SB, for 1½-ton trucks, has a blade that clears a space 7 ft. wide; the height of the moldboard is 24 ins. at the front end and 40 ins. at the rear end. Length of the cutting edge is 8 ft. 8 ins., and overall length is 11 ft. Approximate weight is 935 pounds and the truck attachments weigh an additional 300 pounds. The 25SB, for 2- to 3-ton trucks, clears 8 ft. wide, and weighs 1,235 pounds alone, or 1,535 pounds with attachments. The 30SB, also clearing 8 ft., has a blade 32 ins. deep at the front and 55 ins. at the back. This unit, weighing 1690 pounds with attachments, is suited for 4- to 5-ton trucks.

For use with 5- to 8-ton trucks, the 40SB clears a 9-ft. space with a blade 32 ins. high in front and 59 ins. high in the rear. The plow weighs 1800 pounds and the attachments 400 pounds. Largest of all is the 50SB, for 8- to 10-ton trucks, which clears 9 feet wide, and has a blade 44 ins. high in front and 68 ins. in the rear. This plow weighs 2070 pounds and the attachments 400 pounds.

All of these 5 "one-way" plows have hinged deflectors as standard equipment; reversible cutting edges; adjustable moldboards to permit tipping the top forward or backward, to adjust the height close to or above the road surface, and to compensate for cutting edge wear; and shock-absorbing drive links. The cutting edge is of heat-treated alloy steel. The moldboard is of steel, scientifically paneled and reinforced. All have hand hydraulic lifts, and power hydraulic controls are available.

Austin-Western underframe attachment.

A feature of these Frink one-way snow plows is their interchangeability with the V-plow made by the same company, the same push frame, lifting devices and attachments being used.

Austin-Western one-way blades for 1½- to 2-ton trucks are made in two styles—the fixed angle adjustable tilt, and the adjustable angle fixed tilt. On the former, the tilt or pitch can be adjusted to any one of three positions, so that the cutting edge can enter the snow at the desired angle; on the latter, the blade may be set at various angles with the roadway, up to 55°. This type is, therefore, a combination of the one-way and reversible plows.

The fixed angle blade for 1½- to 2-ton trucks is 9 ft. wide, with a cutting width of 7 ft. 6 ins.; is 24 ins. high in front and 36 ins. at the rear; it weighs 810 pounds; the attachments weigh 640 pounds. The adjustable angle blade is 10 ft. long, with a plowing width of 7 ft. 6 ins.; is 22½ ins. high in front and 35¾ ins. high at the rear, and weighs 610 pounds without attachments. Both blades are of 10 gauge, reinforced top and bottom, with a spring trip. For 2- and 3-ton trucks, an 11-ft. blade is furnished, to plow 9 ft. wide; height in front 24 ins. and at the rear 42 ins.; weight is 1275 pounds, and the attachments weigh 805 pounds.

All of the one-way plows, and also the reversible and V-plows made by Austin-Western, use the same underframe and attachments, so that quick interchange is possible, permitting the some truck to use which ever type of blade is needed. All have hydraulic lifts.

Three sizes of the one-way blade plows are made by Baker. Two of these are for 1½- to 2-ton trucks, one 8 ft. wide and one 9 ft. The 8-ft. blade is mounted on either runners or casters,

Details of construction, Frink

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Turn to pages 67-69 for descriptions of helpful booklets and catalogs.

clears a width of 7 ft.; the moldboard is 24 ins. high in front and 32 ins. at the rear; approximate weight, complete, is 1450 pounds. The 9-ft. blade, 6 ins. higher throughout, is designed especially for trucks with dual tires. For heavy trucks, there is a 12-ft. blade which plows 9 ft. wide, is 36 ins. high in front and 50 ins. at the rear, and weighs, complete, 2750 pounds. Hand hydraulic pumps and jack lift are used on all of these plows. Baker also has a one-way plow designed for the Allis-Chalmers "K" tractor. This weighs 4650 pounds and has power hydraulic controls. This heavy unit is designed for widening deep banks and will cast snow 3 ft. beyond the track of the tractor.

Baker one-way plows (also Baker reversible) are available with a safety tripping feature, and most of them are furnished with this device. The lower or cutting 6 inches of the blade is divided into short sections, and hinged to the moldboard, being supported by heavy springs. When any blade section strikes an obstruction, such as a manhole cover, it trips back; but instantly after passing the obstruction, the blade section snaps back. No piles of snow are dumped back of the blade, and close plowing is possible without danger.

Baker also has a landside blow, the curved landside being bolted on the left end of a one-way plow (left end looking forward). The curved landside gives additional width to the path to be cleared.

Parsons one-way plows are adapted to light and medium size trucks, and are easily attached or detached. There are three models, the moldboard assembly weighing 650, 850 and 925 pounds respectively. All plow 8 ft. wide. The Parsons automatic latch protects these one-way plows from injury. When the plow strikes an immovable obstruction, the latch tips the blade forward, clearing the obstruction. As soon as the plow has passed beyond the obstacle, the automatic latch restores it to working position without any action on the part of the operator. Either hand or power automatic controls are available.

The Root one-way snow plow, for use with light trucks (1½-ton), has a height at front of 28 ins., at the rear of 41 ins., width of cut is 7 ft. 6 in. and the weight, complete, is 1400 pounds. This plow is interchangeable, as far as attachments go, with the V plows, and has a mounting and hitch that is said to permit quick attachment with no alteration to the truck, and even the quick transferral of the plow to another truck.

Gettelman makes a heavy-duty one-way plow that has an extreme blade width of 10 ft. 8 ins. and a cutting width of 9 ft. 7 ins. The height at the front is 38 ins. and at the rear 72 ins. giving the blade a rather extreme flare. The makers say this plow is designed for general heavy work, but is particularly adapted to widening work and to cleaning up at intersections. Either manual or power operated hydraulic hoist can be provided. The cutting edge is reversible.

Tripping subframes are provided on Sargent one-way plows, which permit them to plow close to the surface of the road. Four models of one-way plows are built. For the small truck, there is the O-76, which cuts 7 ft. 6 ins. wide, has a blade 22½ ins. high in front and 44 ins. at the rear, and weighs, without attachments, 1100 pounds. The O-86 is for 2- to 3-ton trucks, has a blade 25 ins. in front and 50 ins. high at the rear, cuts 8 ft. 6 ins. wide, and weighs 1250 pounds; the O-90, for 3½- to 6-ton trucks, cuts 9 ft. wide, weighs 1550 pounds, and has a blade 27 by 50 ins. The largest, the OX, with 32 by 66 inch blade, plowing 9 ft. wide, weighs 1650 pounds and is for trucks over 5 tons. The two larger have convertible moldboards; all have flare deflectors. The same hook-ups will take either the one-way blades described or V plows.

One-way plows with both funnel blades and shovel blades are furnished

Baker Tractor Plow operating in Minnehaha County, S. D.

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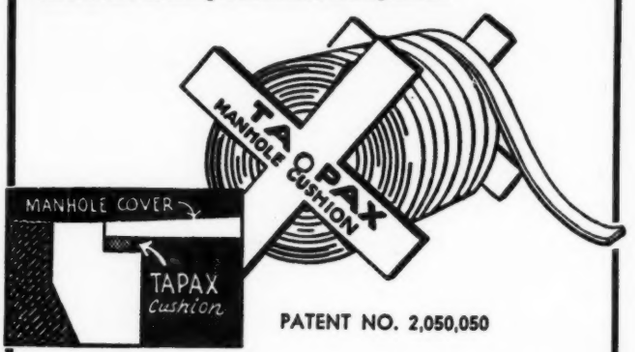

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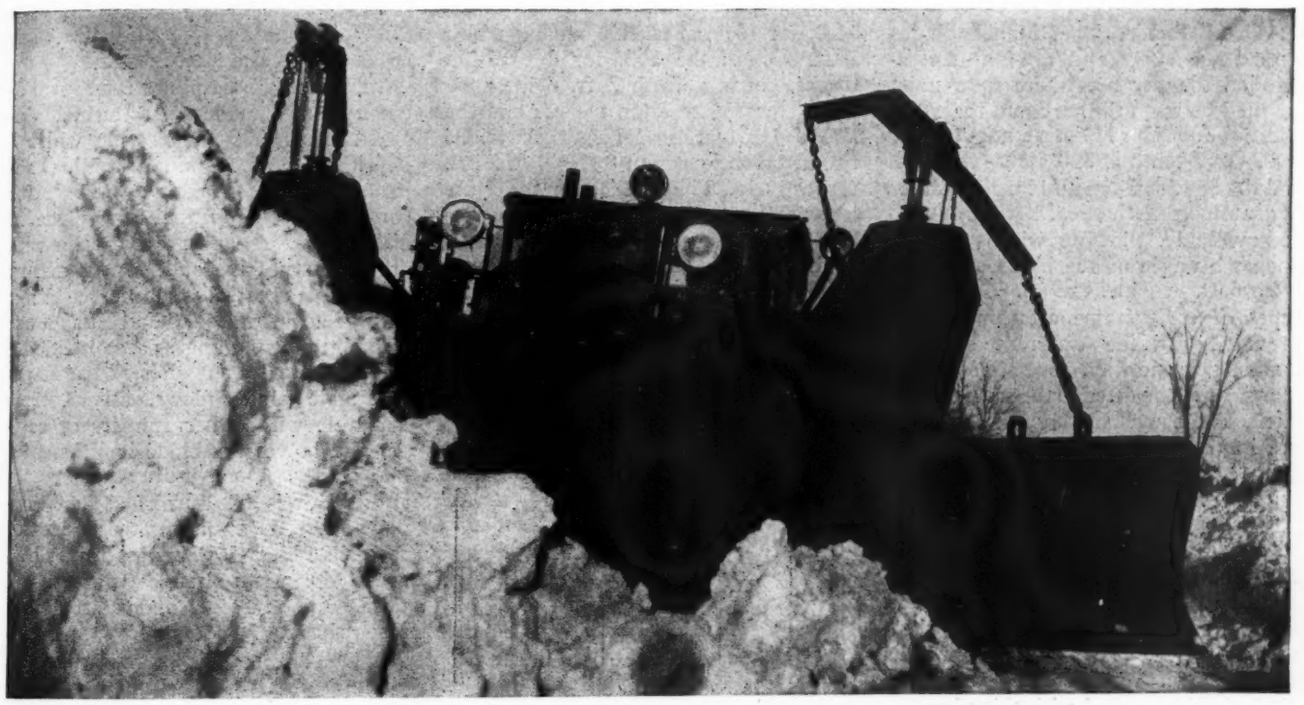

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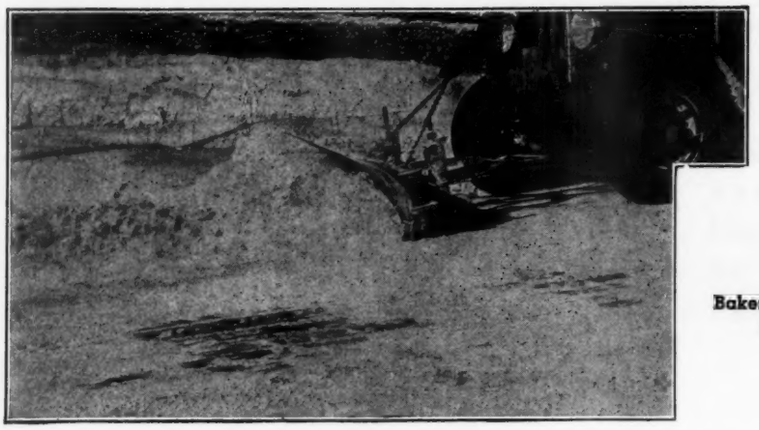
CONTROLLED IGNITION OIL TRACTORS

Turn to pages 67-69 for descriptions of helpful booklets and catalogs.



Baker reversible plow.

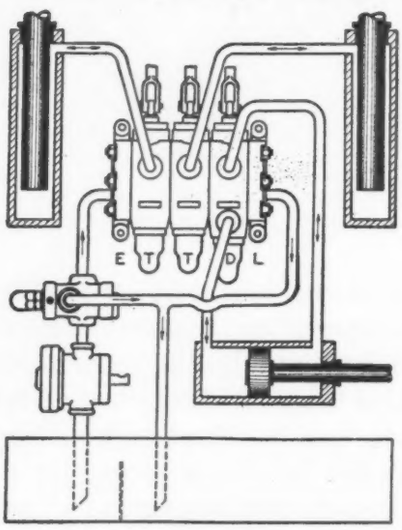
by Good Roads. The funnel blades spread the snow and are not recommended for city use where snow must be piled between the curb and the walk. The No. 300 is for 1½-ton trucks, the 310 for 2- to 3-ton, the 320 for 3- to 5-ton, and the 330 for 5-ton and larger. Either hydraulic or mechanical lifting devices are available. Plowing widths depend upon the angle of the blade and vary from 6 ft. 8½ ins. to 9 ft. ½ in. Five types of underframe attachments are provided for the different sizes of trucks, but one-way, reversible and V plows can all be fitted to the same attachment. The shovel blade one-way plows are in the same range of sizes as the funnel-blade, differing primarily in the shape of the blade.

One-way plows are made by Burch (Ross plows), in sizes for 1½-ton, 2 to 3½-ton, and 5 to 10-ton trucks. The last, the R7-24, is 46 ins. high in front and 64 ins. at the rear; it clears a width of 9 ft. 3 ins. The plow alone weighs 2340 pounds. A rear frame or rear axle hitch should be used with this plow.

American one-way plows are made in four sizes—for 1½ to 2½-ton, 2½ to 3½-ton, 5 to 7 ton and 8 to 10-ton. These have conical-shape moldboards. Wausau also has one-way plows—the 35 for 1½ to 2½-ton trucks and the B-150 for 2½ to 5-ton trucks. A variation of the latter—B-250—is designed especially for FWD trucks. Bros one-way plows are made in four sizes, the 94A, for 1½-ton trucks, cutting width 7 ft. 9 ins.; the 106, for 2 to 3-ton trucks, cutting width 7 ft. 6 ins.; the 150W for 3½ to 5-ton trucks; and the 210W for trucks of larger size. The two last mentioned cut 8 and 8 ft. 7 ins. respectively. The hitches on these are identical and interchangeable with hitches for corresponding V plows. Willet has various sizes of one-way plows, suited for large, medium and small trucks, all interchangeable with the V plows.

Reversible Blades

The reversible blades are suited for use with trucks and also with motor



graders, maintainers, tractors, etc. Quite a variety of these are made though all follow the same general pattern. They are not adapted to deep snow nor to high speeds, but are used for such work as piling snow along the curbs in urban areas.

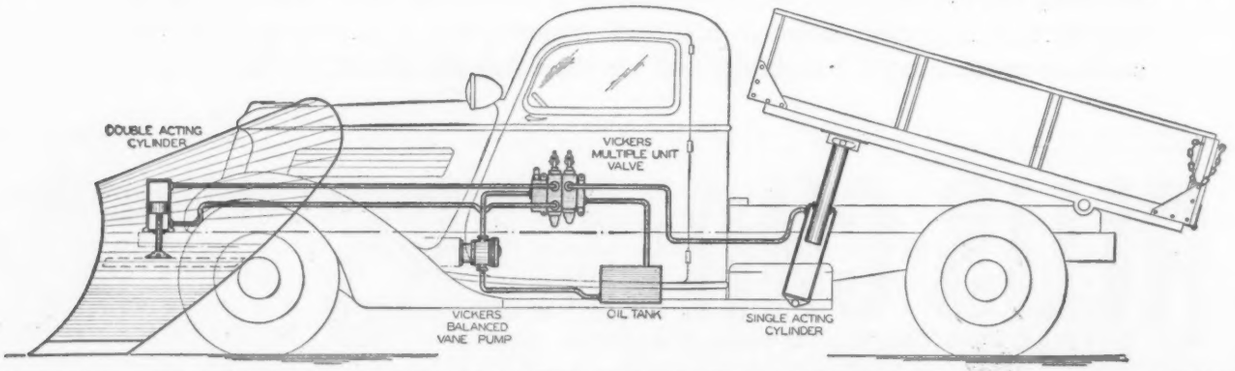
Austin-Western has a reversible or straight blade plow for 1 to 2-ton trucks which is 9 ft. long with a plowing width of 7 ft. 6 ins. and weighs 570 pounds. There is also a blade for 3-ton trucks, which is 10 ft. long, weighs 880 pounds, and clears from 8 ft. 6 ins. to 10 ft. Both of these plows have a blade 24 ins. high; both use the same underframe attachments as the one-way plow of corresponding size and the same types of hoists are available.

Reversible blade plows for 1½ to 3-ton trucks are made by Parsons. Moldboard length is 9 ft., plowing width 7 ft. These have a 12-in. longitudinal adjustment on attachment to provide for varying lengths, channel depths, etc., of different trucks, and are equipped with cable safety trip, and spring return lock. Blade reversal is simple, requiring only removal of four hand pins. Four different plowing angles are provided.

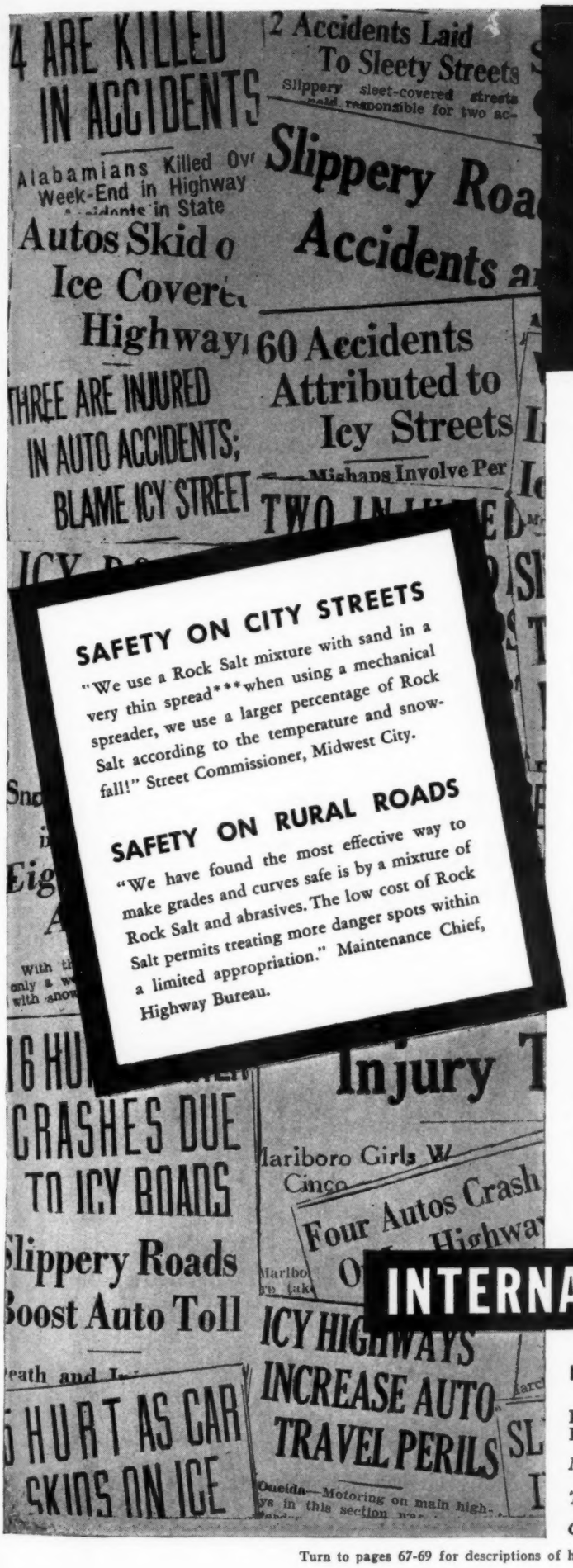
There are four models of the Baker reversible blade plows, all of them available with either runners or casters and in various blade lengths, with trip blades. A heavy-duty model with rigid blade is also furnished for heavy plowing. Wausau makes three sizes of reversible blades. The Ross reversibles are made in two sizes, 8-ft. and 10-ft. to clear 6 ft. 8 ins. and 8 ft. 4 ins., respectively.

Reversible blade plows are made by Gettelman, in 8 ft. widths for 1 and 1½-ton trucks, and 9 and 10-ft. widths for larger trucks; they are 34 ins. high, weigh from 750 to 885 pounds, and are available with hydraulic lifts. The Adams No. 21 plow, which is of the same type, has hydraulic controls, and a 10-ft. blade; it weighs 850 pounds.

The American reversible plows are made in four sizes which correspond generally to the oneway plows made by the same company. These are designed



Sketch above indicates schematically a typical truck installation equipped with power take-off mounting, which may be employed to operate a snow plow or road scraper. Above, schematic representation of method of operation.


4 ARE KILLED IN ACCIDENTS
2 Accidents Laid To Sleety Streets
Slippery sleet-covered streets held responsible for two ac-
Alabamians Killed Ov
Week-End in Highway
in State
Autos Skid o
Ice Covere
Highway
Slippery Roa
Accidents a
THREE ARE INJURED IN AUTO ACCIDENTS; BLAME ICY STREET
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TWO
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NO community where snow falls can count itself safe from the loss of life and property due to icy pavements. In every foot of snowy road or icy street, tragedy waits for the motorist. You can not reckon the value of lives in dollars and cents — but you can estimate the low cost of accident prevention with Rock Salt.

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Turn to pages 67-69 for descriptions of helpful booklets and catalogs.

for trucks of all sizes from 1½-ton to 8 to 10-ton. The same hitches are used as for the one-way and V plows.

Good Roads reversible plows are recommended for airports, towns, boroughs, cities, counties and similar clearing work. These are made in four sizes for 1½-ton, 2 to 3-ton, 3 to 5-ton, and 5-ton and larger trucks. Moldboard length varies with the size from 8 to 11 ft. The moldboards on these are interchangeable with the boards on one-way plows of similar size.

V-Type Plows

For the really heavy work of removing deep snows and drifts, the V-type plows are used. The smaller units, designed for 1 and 1½-ton trucks, are effective in rapid removal of medium, or even light snows, while the big units, with 5-ton and larger trucks can handle almost any requirement. The V plow is therefore both a fast unit, throwing the snow clear of the road shoulders, and also is available for slow, heavy work for widening deep cuts and opening big drifts, with both trucks and tractors. It is also of great value in opening unimproved roads, and in leaving a smooth surface on them. On such types of highways there is seldom available equipment adequate to keep ahead of the storm, so that plowing is heavier. Also, such roads are usually excessively crowned and the V-plow, with absence of side-thrust, is easier to handle. Sargent says the V should be considered standard equipment for unimproved roads and reserve equipment for improved roads.

Frink says that, in selecting a V plow for use with a motor truck, the cutting edge width of the plow should be about a foot more than the overall width of the rear tires of the truck; and he recommends that, if the truck is equipped with dual tires, better results may be obtained by removing the outside tires. If this is done, the cutting width of the plow may be about a foot more than the overall width of the inside duals. He further states that the nose height of the plow will depend upon the average depth of snow to be removed, but also on the power and speed of the truck. He suggests the following:

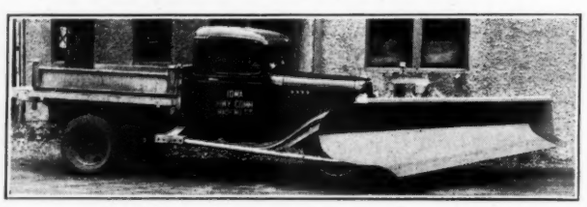
For 1½ to 2-ton trucks, a cutting width of 7 ft. and a nose height of plow of 2 ft. 3 ins.; for 2 to 3½-ton trucks with rear drive and used for light to medium plowing and patrol work, an 8-ft. cutting width and a nose height of 2 ft. 3 ins. For trucks of the same size, with the outside duals removed, when used for medium plowing, a 7-ft. cutting edge and a nose height of 2 ft. 9 ins. For 3 to 4-ton trucks, with overall width not more than 7 ft. for medium plowing and patrol work, a cutting width of 8 ft. and a nose height of 2 ft. 9 ins. Rear drive trucks of 4 to 5-tons, or four-wheel-drive trucks of 3½ to 5-tons, for heavy plowing should use a plow with an 8-ft. cutting width and a nose height of 3 ft. 5 ins. For 5 to 10-ton trucks, for heavy plowing, an 8-ft. cutting edge and a nose height of 4 ft. 8 ins.

Some makers design their V-type plows according to speeds, giving a slightly different shaping for plows to be used at speeds of less than 15 miles an hour than for those that work at higher speeds.

The V plow is generally made by the same manufacturers as the one-way and reversible plows, and in almost every case is so designed that it can be interchanged with these units in similar sizes, the attachments being the same, and changing over usually being a matter of only a few minutes.

Frink makes six models of V plows, for trucks of all sizes. The 117S is for 1½ to 2-ton trucks; the 118S for 2 to 3½-ton rear drive trucks with duals; the 147S for trucks of the same size with single tires or with outside duals removed; the 148S for 3 to 4-ton trucks with duals, but with overall width less than 7 ft.; the 158S for 4 to 5-ton trucks; and the 168S for 5 to 10-ton trucks and the heaviest type of work. Frink also manufactures special heavy-

PARSONS MODERN SNOW PLOWS



Embody latest scientific formation for streamline movement of snow. Greater speed, less power consumed, more snow moved. Built in numerous sizes and styles for large or small trucks.

Reversible Plows
One Way Plows
Vee Plows
Wings

Hand hydraulic or power hydraulic controls. There is a Parsons Representative near you.

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Electric equipment for handling all jobs on services and mains.

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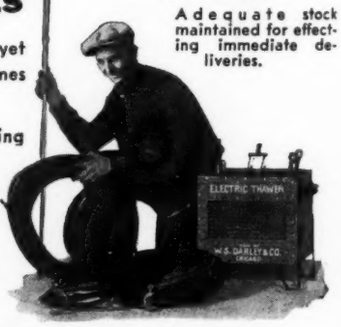

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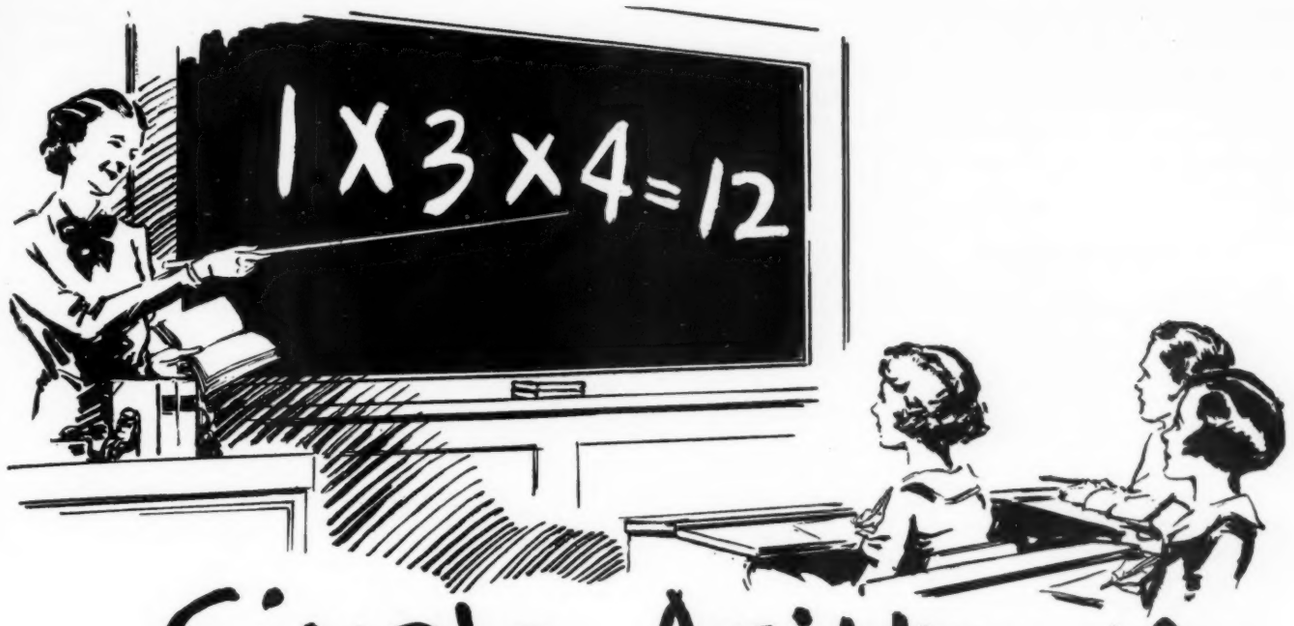

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duty plows especially designed for Linn and Walter trucks.

Further information on V-plows; leveling wings; lifts, controls and attachments; sidewalk plows; rotaries; and snow fences will appear in the November issue.

Loading Equipment

On highways, snow is generally plowed back away from the road and left there; but in the main streets of cities and even of large villages it may have to be removed. Most streets are not sufficiently wide to allow reasonable traffic when there is a snow bank at each curb; moreover, such banks may interfere with garbage collection and with access to fire hydrants, unless these are shoveled out by hand. Complete removal of the snow is the best solution. This has been done in New York and many other large cities by pushing into the sewers; but even in New York, where most of the sewers are short, discharging directly into nearby rivers, such a procedure is not very satisfactory and is likely to be more costly than to haul the snow away.

Plows push the snow into piles in the center of the street or, more often, along each curb, which piles are then loaded into trucks or big wagons and hauled away. Loading by hand is very expensive, even with relief labor, because of the time wasted by the trucks while being loaded. Quick loading, with the trucks always on the move, is most economical.

A number of snow loaders have been developed that will load even the largest truck in a minute or less. These pick up the snow from the windrow continuously, and discharge into the trucks, which load by driving under the discharge spout.

The Barber-Greene loader has a notched spiral feed that picks up the snow from the windrow on the street surface—even when the snow is packed and frozen—carries it up an elevator and discharges it into trucks at the rate of as much as 10 cubic yards a minute. Thus one loader can keep a whole fleet of trucks busy and at capacity. Operated by one man, the loader travels along the snow windrow at a speed that depends on the volume of snow in the windrow. This machine, by changing the snow loader boom and replacing it with a bucket loader boom, becomes a bucket loader for handling sand, gravel, earth, crushed stone and other bulk materials, and is thus useful the year around.

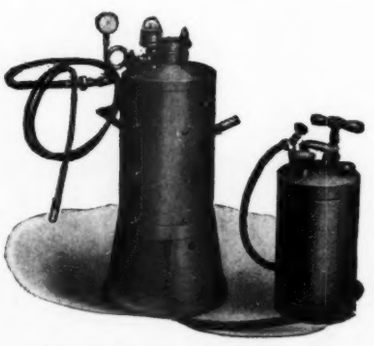
Savings from the use of such loaders are illustrated by Barber-Greene as follows, this being an average case taken from their files: Ten men can load a 5-ton truck with snow, using shovels, in not less than 30 minutes. The average rental price for such a truck is $3 per hour. When a snow-loader is used, the capacity of the truck can be increased to 10 tons by side boards, but it is impractical to shovel into trucks by hand with these high side boards. Assuming it were, it would take the men one hour to load the 10 tons, at a truck cost of $3. With a loader, the 10-ton capacity can be filled in one minute at a truck time rental cost of 5 cents, or a saving of $2.95 on truck time only. Moreover, this saving is effected without taking any money from the unemployed; in fact, they can very profitably be put at work on clearing gutters, cross-walks, etc. In a city of 150,000 population, with 200 miles of streets, 20 miles of which are to be cleared, the saving on one 8-inch snowfall may be as much as $25,000 to $30,000 for truck rentals only.

Barber-Greene furnishes a side discharge attachment, if desired, so that trucks pull alongside the machine and are loaded with no waste time. This will load trucks on either side of the loader.

The Joy loader employs a gathering mechanism at the head for picking up the snow, which is then elevated and discharged into trucks. This unit is mounted on a truck chassis which gives it mobility. The Nelson loader employs a twin spiral feed, an elevator and a discharge chute that will load to either side or the rear.

Power shovels are sometimes employed to supplement loading equipment. Trackson has a high-lift shovel that will load from a windrow into a truck; or the tractor may be equipped with a bulldozer blade for pushing the snow into windrows. Clamshell buckets and cranes also are used by some cities.

For hauling the snow, motor trucks are generally used, the municipal trucks being supplemented by hired trucks and often by garbage collection trucks, since garbage collection is almost impossible with the streets clogged with snow. The big "carryalls," such as those made by LeTourneau, with capacities up to 12, 18 or 24 cubic yards are excellent for this purpose; also other big earth-moving wagons. Often these can be rented from contractors who normally are not busy during the winter months on dirt-moving jobs.



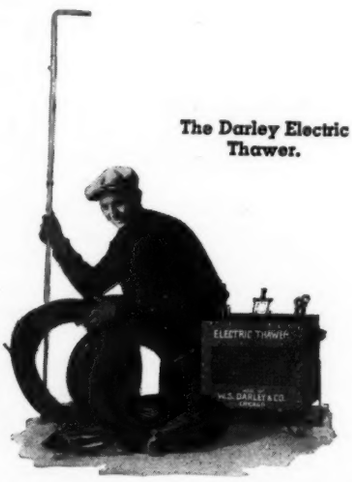
Hauck One-man thawing outfit.

Thawing Equipment

Cold weather problems are not confined to snow plowing, drift prevention and ice control. Water pipes and hydrants freeze, frozen ground must be thawed for trenching; and numberless similar problems occur in the wake of frigid weather. To meet these, thawing equipment is invaluable. One man properly equipped with thawing apparatus can do as much as 8 men with picks, crowbars and shovels. This is especially the case in digging up frozen pipes, hydrants, etc.

Hauck manufactures a variety of oil and kerosene burners for this work, one-man, portable and large. In general, these heat up for use in about 5 minutes. Heaters are also used, when not needed for thawing, for machine repair work, pavement repairs, etc. Hauck steam thawers will produce steam for use in about 10 minutes after starting the furnace.

Electric thawers are made by Darley for thawing frozen pipes. The thawer connects to house wires, using 110 or 120-volt, AC, 60-cycle current. The unit shown weighs 70 pounds. This is especially suited to thawing of house connections and smaller pipes. Larger units are available for thawing up to several hundred feet of main; also Darley manufactures an electric power unit for sections where suitable power is not available.



The Darley Electric Thawer.

Do Not FIGHT SNOW But PREVENT it

Blocking Your Roads by Using

BEACH SNOW FENCE

High Quality, Low Prices

Beach Mfg. Co. Charlotte, Mich.

Street Maintenance Operation in Philadelphia

THIS text includes a general outline of the methods of supervision, organization of gangs, quality and quantity of work, reporting of time and other incidentals bearing on the maintenance and repair of streets and roads in the city of Philadelphia. It is issued by the Bureau of Highway of that city.

Supervision

Supervision will be exercised first by the District Engineer under whom will be a supervisor of maintenance having direct charge of all gang leaders.

Responsibilities of Supervisor of Maintenance.—The Supervisor of Maintenance will be in direct charge of all gangs operating in the district. He will see that gang leaders are supplied with the necessary time sheets and route sheets on standard forms; that the daily time sheets are returned to him on the morning of the next day for which they are made up; that proper entries are made and that the sheet is kept in a neat condition.

He is to see that all the men are on duty at the proper time and work the required numbers of hours. Under ordinary conditions, he is not to allow the gangs to report to the yard merely for transportation out to a job but is to see that they go directly to the work. He is to see that watchmen are on duty at and during the time assigned.

He must accept full responsibility for the quality, quantity and character of the work done by the men under him. He is to regularly inspect the equipment assigned to his division; to see that that which is supplied by contract meets in full the specifications and that that supplied by the City is being kept in good working order. He will be responsible for the ordering or cancellation of orders for trucks supplied by contract and he is to see that the contractor receives such orders or cancellations before 7:00 A.M. daily, or as required.

He will see that the following day's locations at which the gangs will work are in the district office on the afternoon of the day preceding. He is not to change the location of a gang from that as shown on the route sheet without notifying the district office. He is to see that gang leaders are supplied with tapes, rules, line levels, etc.

Inspection of gangs and watchmen.—All gangs are to be visited at least twice a day by the Supervisor of Maintenance and as often as necessary for proper supervision by the District Engineer. District Engineers are to see that the night watchmen are checked up from time to time. If they are found to be off the job, recommendation is to be made for immediate discharge.

Organization of Gangs

The average composition of repair gangs will be as follows:

General Block Repairs: 1 leader paver, 3 pavers, 1 rammer, 7 laborers, 1 double team.

Jitney Gang: 2 pavers (1 paver acting gang leader), 1 rammer, 4 laborers, 1 small truck.

Concrete Gang: 1 assistant foreman, 7 laborers, 1 truck, 1 compressor.

Asphalt Ditch Gang: 1 assistant foreman, 6 laborers, 1 truck, 1 trailer tool heater.

Macadam Resurfacing Gang: 1 foreman, 12 laborers, 1 truck.

Macadam Patching Gang: 1 assistant foreman, 8 laborers, 1 truck or 1 tractor and trailer, 1 asphalt heating kettle.

Inlet and Drain Cleaning Gang and Drainage Canals: 4 laborers (1 laborer in charge), 1 double team.

Entomology Gang: 1 assistant foreman, 8 laborers, 1 truck or 1 tractor.

Emergency Gang: 1 paver (acting gang leader), 4 laborers, 1 truck.

Storeyards: Each storeyard to be in charge of a responsible storekeeper.

Laborers and watchmen are to be divided among the various storeyards to take care of the requirements.

It is to be understood by every one having general supervision of these gangs that while the title and the organization of the gang designates it as suited for a particular type of work, nothing is to prevent the District Engineer from using any gang to do any kind of work in his district when the emergency arises.

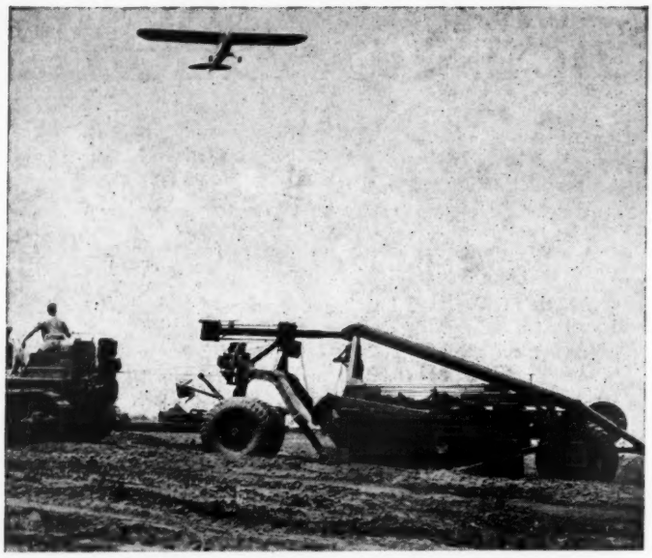
Responsibilities of gang leaders.—Gang leaders are to be familiar with the district in which they work and must be able to read and write. They are to follow the route sheets given them.

Where they observe conditions in the paving which require repairing, the locations of which do not appear on the route sheet, they are to make a note of them and advise the Supervisor of Maintenance. If, however, they discover a dangerous condition, they are to make immediate temporary repairs notifying the Supervisor of Maintenance of the location and the work done, as soon as possible. The gang leader is to lay out the work, from his route sheet, far enough in advance of the gang to prevent delay.

He is to see that sufficient materials are supplied; that the proper tools are available, and that the site of the operation is cleaned up before the gang moves to the next location. If, however, work is not completed at a certain location on the same day, the gang leader is to see that it is properly barricaded and red lighted and that in the daytime, sufficient warning signals are provided.

The gang leader is to see that his men report on the job at the location assigned, ready to work, at the starting time in the morning; that they take no more then the prescribed lunch period and that they do not stop work until the prescribed quitting time in the evening. In the case of an emergency, where it is necessary to work the gang overtime in order to make a condition safe, he is to do so. He is to see that proper barricades and warning signs are established and that traffic is not interfered with any more than is necessary.

The gang leader will be held responsible for the proper use and care of tools and equipment in his gang. Dull tools are to be exchanged for resharpened or new tools. Materials are not to be dumped or spread so that they will interfere with traffic, block inlets or drainage, or spill in the vent boxes on footways.



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Pavers, acting as gang leaders, are to assist in the paving work. Gang leaders are to get in touch with the district office before laying off men or gangs due to rain or other causes during regular working hours. The gang leader is to make a complete report and send it to the district office upon the occurrence of accidents to men in the gang or to other persons or vehicles, due to the gang's operations.

Gang leaders will be held responsible for making up the daily time sheets of the gang. (White in color for paved streets; yellow for country roads; blue for asphalt division.) The names of the men in the gang will be typed on these sheets in the district office sometime in advance of the day on which they are to be used. However, should the gang leader find that a man or piece of equipment had been assigned to his gang but does not appear typed on the time sheet, he is to write it in.

He is to enter on the time sheet each day, the exact time the gang worked on each location, measurements and quantities of all materials used in making each repair. The starting point of the gang for the next day is to be noted on the bottom of the daily time sheet. The time sheets will be collected early in the morning of the next day from each gang leader by the Supervisor of Maintenance. When a gang leader receives permission to be off duty, he is to see that some one has been left in responsible charge of his gang until his return.

The yard man or storekeeper in charge of each yard is to see that the men in it work; that gangs going in for supplies do not idle their time, and that the yard is kept in a neat and clean condition. He will also be responsible for recording correctly the entries in the stock book and for the proper checking of that book with the materials and supplies on hand. He will see that no unauthorized person receives any supplies from the yard.

Use of warning signs.—Standard warning signs are to be displayed at all times at the location at which a gang is working. The signs are to be applicable to the work being done. Dilapidated or broken signs are to be sent in at once, and new ones obtained. These signs are to be placed far enough away from the gang to permit sufficient warning to traffic. As the gang moves, the signs are to be moved. When the men are working in or near sharp curves, signs are to be located at the far tangent of the curve, or beyond as the condition warrants for safety.

When one-way traffic is permitted, guards with red flags are to be stationed, one at each end of the barricaded section, so that traffic in one direction is stopped while that in the other direction moves.

Gangs—working time.—All gangs will work 8 hours per day unless otherwise ordered. Ordinarily the working time is from 8:00 A.M. to 12:00 N., and from 12:30 P.M. to 4:30 P.M. Foremen are to see that the tool boxes are opened before 8:00 A.M. and that the tools are not put away until 4:30 P.M. All gangs are to report in the morning in time to be ready for work at the starting location as shown on the route and time sheets.

Men in charge of storage yards are to see that the yards are opened and ready for use before 8:00 A.M. Any one who fails to report on time in the morning or at the end of the lunch period is to be sent home, losing his pay either for the whole or part of the day.

Quality of Work

District Engineers and Supervisors must bear in mind that expense is not to be considered where quality of repairs is concerned. Temporary repairs, when required, are to be made as quickly and as cheaply as possible and

in such a manner that the condition will remain safe until final repairs can be made. Cinders are not to be used to fill in depressions in hard wearing surfaces unless the surface is first broken down or the paving removed.

A final repair must be made with such materials and in such a manner that the finished repair will appear an integral part of the pavement. All joints are to be cut vertical, no lap joints will be permitted. Joints in the surface are not to overlie joints in the base but must be offset at least 6 inches. Concrete or bituminous material for base replacement in ditches is to be 8 inches thick, thoroughly tamped. The old concrete or bituminous base is to be cut out at least 6 inches wider than the width of the original ditch or reasonably far enough beyond that point to reach good old base.

The mix for concrete base is to be made in proportions of one part early strength cement, 3 parts of concrete sand, 6 parts coarse aggregate. Freshly placed bases are to be protected from injury by traffic. Materials for concrete mixtures are to be measured in one cubic foot boxes. The finished surfaces of ditches are to be paved flush with the finished surface of the street and not above or below. The surface of the concrete base for brick and block paving is to be smooth, that for asphalt rough but not porous.

When using bituminous materials that require heating, gang leaders must use great care to see that they are not overheated, as with too much heat, the binding quality of the bituminous material is destroyed.

Bituminous mastic filler, when using asphaltic material as a binder, is to be mixed in the proportion of 70 parts hot sand and 30 parts of hot asphalt, but when using tar compounds, proportions are to be 80 parts hot sand and 20 parts of hot tar compound. Only enough mastic is to be placed in the joints to fill them. There is to be no excess on top of the block. Depressions 1 inch or less in depth are not to be plugged.

In making bituminous repairs, the gang leader is to see that the spot to be patched, after the edges have been cut, thoroughly cleaned out and bituminous paint applied for the full depth of the joint.

Box—setting or resetting.—Corporations' boxes will be set or raised by the respective corporations interested upon notice from the District office. When it becomes necessary to raise sewer or water boxes, care must be taken to see that none of the old material falls in the opening. Boxes are to be set on a firm cement mortar and brick foundation, or material of equal strength set in cement mortar; the mortar to be a measured mix of 1 part early strength cement and 3 parts sand. A broken box or one unsuitable for replacement is to be renewed.

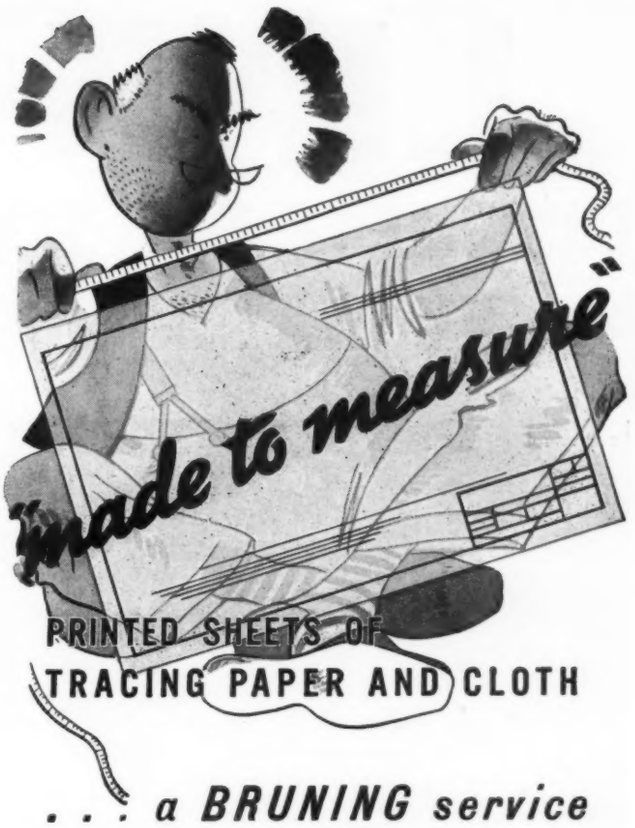
When it is necessary to remove the base, paving and foundation surrounding a box in order to reset it, replacements of paving and foundation are to be made as stated for ditches in paragraph "Quality of Work." When boxes are to be reset on streets to be covered with asphalt binder and top (averaging 2" in depth), new concrete base 8 inches thick is to be placed within the excavated area, around the box after resetting, 2 inches below the surface of the box. In resetting boxes, particular attention must be given to the grade and to the curve of the shoulders.

Quantity of Work

General Block Repair Gang.—The pavers are to average 40 square yards each per day, when working on large areas.

Jitney Gang.—This gang ordinarily is to make small

(Continued to page 59)



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Street Maintenance in Philadelphia

(Continued from page 55)

repairs on brick and block streets and the gang should average 30 square yards per day.

Concrete Gang.—This gang is to be used mainly to replace the base in ditches but it may also be used to place base where general maintenance is required. It should average 30 square yards of base per day.

Asphalt Ditch Gang.—This gang is to be used mainly in repairing the surface over ditches in asphalt streets and should average 50 square yards per day. Hot materials are to be obtained from the nearest asphalt plant

Rainy Days

Reporting and payment.—Salaried foremen, assistant foremen and gang leaders will report on their various jobs to see that everything has been left in a safe condition. They will then proceed to the nearest storeyard and await instructions, unless otherwise ordered.

Gang leaders on per diem rolls, reporting for work in the morning, will be paid for 4 hours if conditions make it impossible to work. For rainy days following this in succession, only one hour will be paid for reporting. If, however, they are ordered on special or emergency duty, they will be paid for the time worked in excess of 4 hours on the first rainy day and in excess of one hour following this in succession. Gang leaders must not, under any circumstances, leave or go home before such instructions have been received from their superior. Laborers who report for work will be paid one hour.

Equipment.—Only sufficient City owned equipment to take care of the emergency repairs is to be ordered out on rainy days.

Borrowed equipment or labor.—When labor or equipment is temporarily loaned to a district but no change has been made on the payroll, the District Engineer is to see that a detail time sheet other than the time sheet for the gang is made out for each person or piece of equipment, signed by him and sent to the district or division by whom the loan was made.

Storeyards.—All storeyards are to be kept in an orderly manner and clean condition. Materials are to be so piled that they will not become mixed. Extra tools are to be kept in a tool shed, bins or racks, properly classified. Nothing is to be given out by the storekeeper except upon receipt of an order signed by an authorized person, a list of which persons is to be made up by the District Engineer with actual signatures included and kept on file at the storeyards for reference. The stock book and inventory of tools, equipment and supplies, is to be checked monthly.

Matrials—delivery, storage, sampling.—Materials are not to be stored outside City yards unless absolutely necessary and then are to be so placed that drainage will not be blocked, private property destroyed, or other dangerous conditions created. Materials delivered to storeyards are to be weighed where scales are available. the actual weight noted on the back of the ticket that is retained by the City, and the ticket signed by the weigher. Cement is to be placed in the storage shed so that the bags which have been stored the longest are used first. Materials stored on the street over night must be red lighted.

Gang leaders are to check all materials delivered to them by contractors for quality and quantity, and if the material appears unsuitable for use, they are immediately to get in touch with their district office for instructions. Receipted copies of delivery tickets collected by

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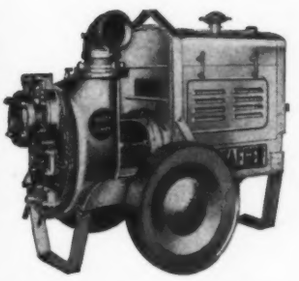

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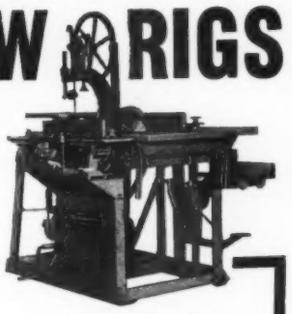

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the gang leaders from the contractor delivering materials are to be returned to the district office daily with the daily time sheet. Unless otherwise ordered, all materials are to be sampled and approved by the Engineer of Tests before being used.

Absence of employees—sick.—An employee unable to work due to sickness is to notify the district office within three days, either by sending in a certificate from his doctor, telephone communication, or postal card. These records are to be kept by the district office. The District Engineer is to see that the employee who has reported sick is visited at least once a week by some disinterested party in his district. Reports of the findings of such visits shall be made out and kept on file, with the sick report, in the district office.

No payment will be made for sick time. No employee is to be absent for any other cause without having first obtained permission for such absence. Employees who have been sick and are found able to do light duty may return to work and be placed on light duty if they desire any pay. However, this light duty is to last only as long as it takes the employee to reach the point where he can resume his regular duties.

Accidents.—When an accident occurs, either to an employee or to some other person, during the progress of any work, a report is to be made out immediately by the District Engineer, on the forms provided for this purpose and sent to the Main Office. If the accident has occurred to one of our own employees and he has been absent due to the injuries and then, after a time, returns to work, the District Engineer is to immediately make a report to the Main Office advising it of the employee's return. A letter, confirming this action, is to follow, directed to the Chief Clerk of the Bureau and recommending payment to the employee only for the time that he would have made had he been able to work.

The District Engineer is to see that regular visits are made to injured employees and reports kept, the same as stated under paragraph reading "Absence of Employees—sick."

Questions and Answers

Thawing Pipes Electrically

I would like some information on thawing pipes electrically. A Superintendent of Public Works in Illinois.

Ans. Thawing pipes by electric current has the advantage that no digging is required; consequently it has come into common use. Where current is available from power lines, it can be used through transformers. It is best to arrange with the power company for this. Where current is not available in this manner, power must be generated. Two or three firms make a specialty of furnishing such generating units. More current is required for large pipes; a small unit may be satisfactory for services but not for mains. With adequate capacity, several hundred feet of main may be thawed at a time. Costs for thawing services are reported to have averaged $8.50 each. When properly handled, there should be no danger from the use of current, and no damage to joints or other parts of the mains. For fuller data see Public Works, August, 1934, and the Manual of Water Works Equipment and Material.

H_2S in Sludge Digestion Gas

Will prechlorination materially reduce the formation of hydrogen sulphide in the gas collection system of a separate sludge digestion type of plant, capacity about 300 gpm? A Civil Engineer in Minnesota.

Ans. We do not think that prechlorination will have any effect on the hydrogen sulphide content of the digester gas. If there is odor also in the primary settling tanks, prechlorination at a point above the tank and in the influent sewer will prevent the formation of hydrogen sulphide in these tanks; or if this gas has already been formed, it will combine with the chlorine and eliminate odor. The principal effect of hydrogen gas in digester gas is its tendency to corrosiveness. But such corrosiveness occurs only when moisture is present. Prevention of corrosion is attained by scrubbing the gas by passing it through iron oxide, or by keeping the pipes at such a temperature that moisture in the gas does not precipitate. We are asking the manufacturer of the digester to write you more fully.

We believe that the H_2S in the digester gas is most likely due to sulphates in your water supply.

Algae in Reservoir

I would like to have information on correction of algae troubles due to storage in shallow reservoirs. A Superintendent of a Bureau of Water in New York.

Ans. A reprint on "Basic Principles of Taste and Odor Control" by E. A. Sigworth, the original of which appeared in our April, 1937, issue, is being sent you. This covers the subject briefly, but quite thoroughly. For further data, the booklet by Dr. F. E. Hale, which is available from the Nichols Copper Co., is excellent. Copper sulphate is probably most effective for large reservoirs; for concrete basins, either copper sulphate or chlorine can be used. Where practicable, roofing reservoir to shut out light will prevent growth of algae; also will reduce loss by evaporation and heating in summer.

Painting Inside of Elevated Water Tank

What is the best paint to use for the inside of an elevated water tank? A Superintendent in Iowa.

Ans. Asphalt pigment paints are more generally used for this work. It is often impracticable to permit sufficient time to elapse between successive paint coats and before placing water in the tank to permit complete hardening of red lead paint. If water is placed in a tank before the red lead paint has completely hardened, objectionable tastes may be produced, which may continue for some time.

Stand-by Pump for Well

Diesel equipment for standby for deep well pumping. A Water Superintendent in Washington.

Ans. For purely standby power equipment, which is to be used only rarely, we question whether diesel engines are worth their extra cost. Diesels are advantageous and economical to operate, but if they are to be operated only at infrequent intervals, the economy which justifies their added first cost does not apply. By this, we do not mean that standby engines should be cheap or second-rate equipment—indeed, just the reverse. When standby equipment is needed, it is needed very badly. Therefore, we recommend that the very best type of equipment be purchased, with most emphasis on quality, simplicity and reliability, and less on economy of operation.

Sewer Construction

I have just taken over responsibility for our sewer system and would like information on sewer construction. A Superintendent of Water Works in Massachusetts.

Ans. Under separate cover we are sending a copy of the Manual of Sewage Treatment Equipment and Sewer Construction, which we believe will be of assistance to you.

Storing Redwood Pipe

I would like to know how to keep a stock of 16-inch redwood pipe from drying out. A Superintendent of Water Works in Wyoming.

Ans. Wet thoroughly with a solution of calcium chloride or other hygroscopic salt, or cover with wet earth, and keep a waterproof covering over it. This may not prevent it from checking and cracking in very dry weather, but will afford some protection.

Road Show

diversion, highway planning, education of highway engineering students, development of highway construction equipment, highway legislation, Federal-Aid benefit for secondary roads and municipalities, the contract system in highway work, highway illumination, and Federal rules and regulations for highway work. He will definitely not want to miss the gathering of 20,000 of the nation's leading highway officials, engineers, contractors, manufacturers and distributors. His presence at the 1938 Road Show and Convention will afford him the opportunity to "swap talk" about mutual highway problems with road men from the 48 states and 25 foreign countries.

. . . .

Hotel reservations are now being made through
Mr. Mark Egan, Chairman, A.R.B.A. Housing Committee,
1604 Terminal Tower . . . . . Cleveland, Ohio

BUILDERS' ASSN.
NATIONAL PRESS BUILDING
WASHINGTON, D.C.

Keeping Up With New Equipment

A New Top for Old Valve Boxes

In re-paving or re-surfacing of old roads and the construction of new pavements, the grades of the streets are often changed, with the result that valve boxes may be covered or project above grade.

Rite-Hite Valve-Box Top Installed

The cost of raising or lowering valve boxes to bring them to the right heights in relation to the road surfaces, amounts to a considerable sum in the course of a year with most operators of underground systems.

The "Rite-Hite" affords a quick, easy and inexpensive method of forming a new valve box top at the right height without digging up the old box. With a small expediture for labor and materials, any installation can be completed in a few minutes time. These may be used with any type valve box and the Buffalo type cover fits the "Rite-Hite" top.

Full data from Trohn's Supplies, Inc., 205 Hoyt Ave., Mamaroneck, N. Y.

Le Tourneau 15-Yard Buggy

A new 15-Yard pneumatic-tired buggy, designed particularly for rock jobs, long hauls, hauling ore or gravel, or work on levee jobs where digging must be done by dragline or shovel, is announced by R. G. Le Tourneau, Inc., of Peoria, Illinois, and Stockton, California. Except for capacity, it is very similar to the 24- and 30-Yard buggies.

New Le Tourneau Buggy

Unloading takes less than a minute and can be accomplished on the move, so the load can be spread, or standing still.

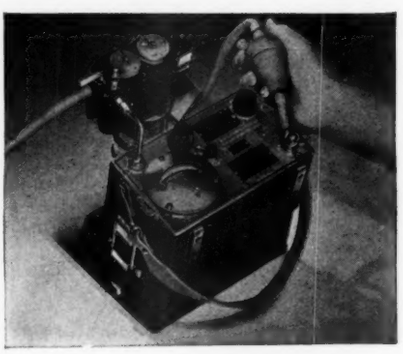
The 15-Yard buggy is built primarily for use with shovels and draglines working in material that is too hard for scraper loading. It maneuvers like a two-wheel cart, consequently, is easily spotted; its large body makes unnecessary the careful spotting of the shovel or dragline bucket.

Four 18 x 24 pneumatic tires and Timken roller bearings make for very light draft. Its big tires keep it on top of soft going, its light draft makes tandem operation practical if desired.

Like all Le Tourneau equipment, the 15-Yard Buggy is built out of alloy steel, arc welded throughout. The bottom is wood-filled and stoutly reinforced for handling the most punishing of loads. It has a struck measure capacity of 11.84 cubic yards and a heaped measured capacity of 15 cubic yards. Weight is approximately 14,500 lbs. It is built for use with "Caterpillar" RD7 and RD8 tractors, and is cable-controlled by Le Tourneau single drum power control unit or by a double drum power control unit when used in tandem.

A Mechanical Smeller

The Linde Air Products Company, New York, announces a gas indicator for quickly and easily detecting explosive or irrespirable gas-air mixtures.

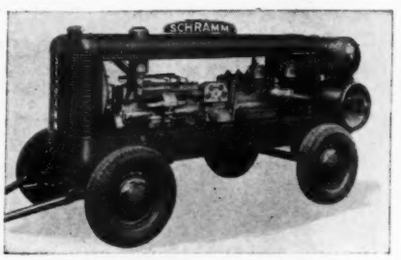


Linde Gas Indicator

These instruments are designed to fulfill the requirements of public utilities, gas plants, shipping companies, petroleum companies, paint and lacquer companies, solvent manufacturers, fire departments and insurance companies for locating underground leaks, establishing purge-end points, and determining hazardous conditions in manholes, oil tankers, oil storage tanks, holds of ships, sewers, conduits and tunnels. These are available as follows: 12-B for the detection of combustible gases or vapors. A graduated meter scale indicates by direct reading whether combustible gases are present, and, if they are, whether concentrations are above, within, or below explosive limits. For increasing the utility of this instrument, a flame-type safety lamp attachment is available which makes it additionally possible to detect oxygen deficiencies; B-1 combines three units in one. It shows the presence of combustible gases, indicates an oxygen deficiency, and, in addition, includes a toxic chamber for determining the presence of carbon monoxide and hydrogen sulphide in dangerously toxic concentrations.

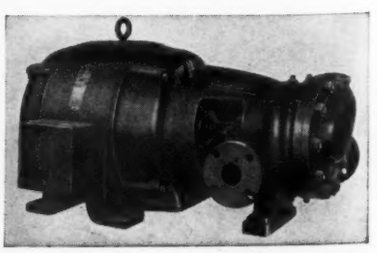
Schramm Utility Compressor

Schramm Inc., West Chester, Penna., makes the "Utility" air compressor in 85, 105, 160, 210, 260, 315 and 420 cu. ft. actual air delivery in both gasoline and diesel engine driven models. Weight savings up to 3500 lbs. in the gasoline powered models and up to 8000 lbs. in diesel powered machines is a feature of this compressor.



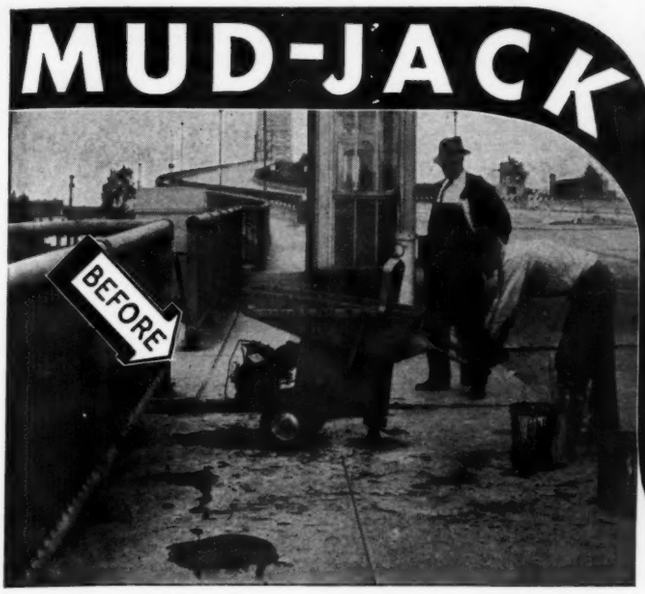
Schramm Utility Compressor

Straight-in-line cylinder construction is used, with force-feed lubrication to all seven main bearings. Other features include electric self-starting, self-aligning clutch between compressor unit and motor, mechanical intake valves, discharge valves occupying entire area of head, water cooled engine and compressor and special attention given to modern, streamlined finish and all details of construction.



Fairbanks, Morse 2-stage built together pump for heads up to 500 ft. Pump and motor are built together. Little space needed. Simple installation. Ask for Bulletin 5592, Fairbanks, Morse, Chicago, Ill.

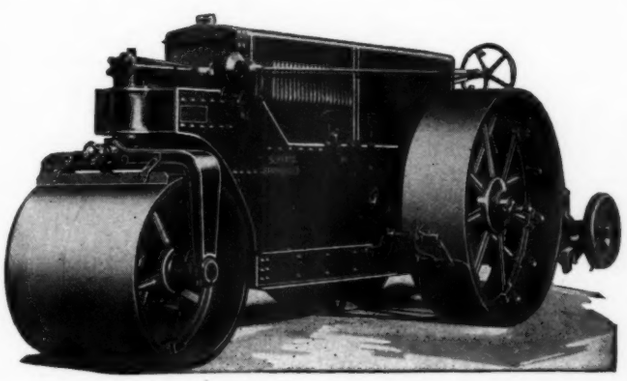
MUD-JACK METHOD



Sunken concrete slab is raised to correct grade by the Mud-Jack Method — preventing breakage of the slab and eliminating reconstruction costs.

Increase the life of concrete slab by the Mud-Jack Method. Write for information about economical maintenance of curb, gutter, and sidewalk slab.

KOEHRING COMPANY
Pavers · Mixers · Shovels · Cranes
Draglines · Dumptors · Mud-Jacks
3026 WEST CONCORDIA AVE. MILWAUKEE, WISCONSIN

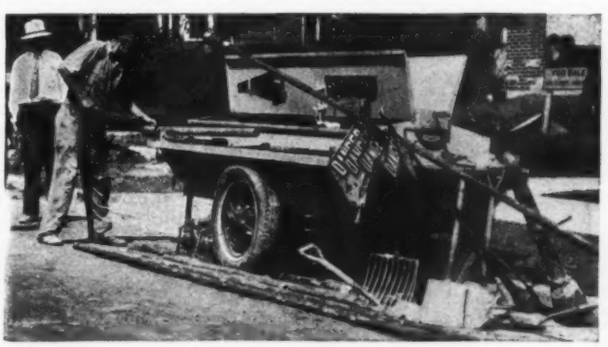


ESSENTIALS

● Long life and low operating costs should be considered above all other features in the selection of a road roller. Buffalo-Springfield's ability and reputation for furnishing these essential qualities have remained unchallenged for forty-five years.

THE BUFFALO-SPRINGFIELD ROLLER CO.
SPRINGFIELD, OHIO

A SAFE PLACE
To Store Your Tools



ON THE JOB

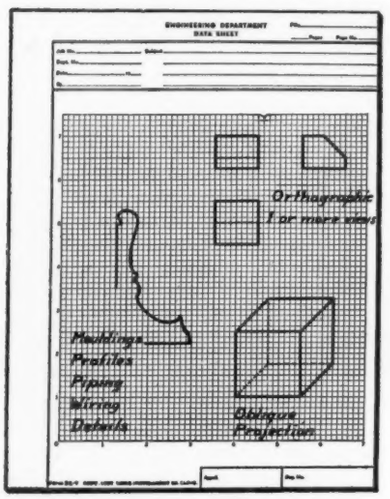
Your tools and records have a safe place out on the job when you use the LB HanDeeBox. All steel construction; covers locked full length of box with one lock. You can store all the tools your crew needs in this safe, long lasting, fireproof, trailer type box. Write for full data, now.

LB — BLACK TOP ROAD MAINTENANCE EQUIPMENT — SINCE - 1909
LITTLEFORD
LITTLEFORD BROS.
452 EAST PEARL STREET
CINCINNATI, OHIO

Turn to pages 67-69 for descriptions of helpful booklets and catalogs.

Sketch Sheets

These have a 7 x 7½-inch drawing area laid out in ⅛-inch squares with inch lines heavy and numbered on 8½ x 11 sheet. Identification lines are provided. Handy for all types of sketches, records, operations and estimates. Also available with a 7 x 10-inch sketching



Wade Sketch Sheets

area without other printing. Black ink or pencil drawings stand out distinctly and make clear blueprints. The tracing paper will not deteriorate and so can be used for permanent records.

These are made by Wade Instrument Co., 2246 Brooklyn Station, Cleveland, Ohio, who also manufacture isometric and perspective paper that is very handy.

A Catch Basin Cleaner

Owned and operated by the City of Niagara Falls, N. Y., is this model EQ Mack eductor truck of 1500 gallon capacity. Used for cleaning catch basins and manholes, the unit before going to the job is first filled with clean water. This water is pumped into the basin to flush it and then drawn back into the tank by suction hoses. The dirty water is then taken to a nearby sewer where it is disposed of. In flood times this unit is also used to pump out cellars and buildings, and in emergency cases it also serves for street flushing.

Catalogs and Booklets

Rotary Displacements Meters lists meters, gives general operating principles and shows proof curves. Ask for 40-B-12, Roots - Connersville Blower Corp., Connersville, Ind.

Crushing and Screening Plants, Austin-Western Road Machinery Co., Aurora, Ill., 8 pp., describes the new No. 70 and No. 80 portable crushing and screening plants. Another 12 pp. booklet describes the No. 100 plant.

Friction Clutches are covered, and data on size, dimensions, weights, h.p. ratings, etc., are given in Catalog 1532, issued by Link-Belt Co., 307 North Michigan Ave., Chicago, Ill.

Crushing Plant Accessories, including vibrating screens, revolving screens, trucks, bucket elevators, conveyors, feeders, bins, buckets, etc., are covered in detail in a 16-page catalog just issued by Iowa Mfg. Co., Cedar Rapids, Iowa.

Simplex Aerators are described and information on operation given in an 8-page illustrated booklet issued by Simplex Ejector and Aerator Corp., Chicago, Ill.

News of Engineers

William Raisch, formerly of Municipal Sanitary Service Co., has opened an office as consulting engineer, specializing in sanitation, at 227 Fulton St., New York, N. Y.

Charles D. Bottomley, sanitary engineer of Dorr-Oliver Co., Ltd., London, has returned to England after several weeks in the United States, during which time he inspected many sewage treatment plants and attended the opening of the new experimental plant at Westport, Conn.

William Russell, chairman of Dorr-Oliver Co., Ltd., and John Grothe, engineer of Dorr-Oliver N. V., also visiting in this country, have returned to England and the Netherlands.

R. B. Davis has been appointed assistant to the general advertising manager of Westinghouse Electric & Mfg. Co.

Neil Jersey, for the past twelve years sales manager of the W. A. Riddell Co., Bucyrus, O., has been promoted to vice-president and general manager, succeeding the late H. F. Holbrook.

J. A. Hadley has resigned as engineer of the Gibson County, Tenn., Highway Commission, and accepted a position as Division Engineer with the State Highway Department at Jackson. Vernon Wyatt succeeds Mr. Hadley as engineer for Gibson County.

News of Industries

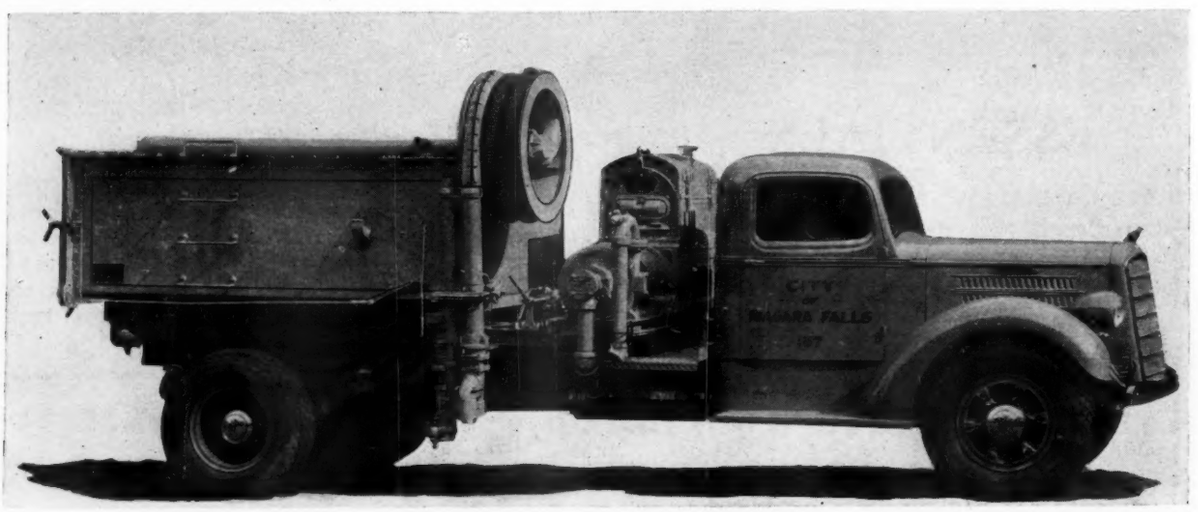
Economy Pumping Machinery Co., Chicago, Ill., has changed its name to "Economy Pumps, Inc."

The Tractor Division of Allis-Chalmers Mfg. Co., Milwaukee, Wisc., has announced an expansion program to cost about $4,000,000. This will include improvements at the West Allis, Springfield and LaPorte plants.

Caterpillar Tractor Co. announces additions and improvements to their Peoria plant to add about 7 acres of floor space.

Big Sewage Equipment Order.— Four centrifugal pumps (2 of 15 mgd and 2 of 35 mgd capacity) and 8 gas engines (80 to 180 hp.) were purchased by the New York City Department of Sanitation from Worthington of Harrison, N. J. Total of contract was $469,000.

Screenings Dewaterer for Minneapolis-St. Paul. — The Minneapolis-St. Paul Sanitary District has purchased from the American Centrifuge Corp., N. Y., a centrifuge to dewater from two to more than four tons of ground screenings daily. These will be mixed with from 15,000 to 35,000 gallons of water, and the centrifuge will produce a cake containing not more than 70% moisture.



Mack Eductor Truck used by City of Niagara Falls

Readers' Service Department

CONTINUED FROM PAGE 68

These booklets are FREE to readers of PUBLIC WORKS.

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Large Cast Iron

408. Handy cast iron pipe and fittings catalog contains A.W.W.A. and A.G.I. standard specifications for a wide variety of cast iron pipe specialties, both bell and spigot and flanged; also dimensions Lynchburg Foundry Co., Lynchburg, Va.

Pipe, Steel

409. A very complete, 60 page, illustrated bulletin on spiral welded pipe including lots of useful engineering information, hydraulic data, flow charts, specifications, etc., issued by American Rolling Mill Co., Pipe Sales Div., 1101 Curtis St., Middletown, Ohio.

Pipe Forms

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

413. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

414. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

417. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

422. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

424. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Run-off and Stream-Flow

425. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

428. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straight-line Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Booklets and Data For Your Winter Library

349. "V Type Sno-Plows for Every Size Motor Truck" describes and illustrates all features of the Frink V type plow, including the new power hydraulic control as well as the earlier types of lifting devices. Also describes and illustrates 14 styles of leveling wings and the different attachments which may be used in connection with them. Just issued by Carl H. Frink, Mfr., Clayton, N. Y.

350. One-Way Speed Sno-Plows are illustrated and described in a 4-page catalog. Features, specifications, methods of attaching. Carl H. Frink, Clayton, N. Y.

351. New catalog, with previously unpublished pictures of snow fighting, and data on 1937-38 V, One-Way and Reversible plows and Wings, with improved power hydraulic controls. Parsons Co., Newton, Ia.

352. Snow Plows for 1¼ to 2-ton Trucks, Bulletin 1698; snow plows for 3-ton trucks, Bulletin 1699. Cover straight-blade reversibles, one-way and V plows. Controls; specifications. Austin-Western Road Machinery Co., Aurora, Ill.

353. 36-page booklet on snow plows, with data on use, descriptions and specifications. Covers V, One-Way and Reversible plows for trucks; separate booklet covers tractor plows. Ask for Booklet 592. Baker Mfg. Co., Springfield, Ill.

354. Data on V plows for use with Galion graders and maintainers. Galion Iron Works & Mfg. Co., Galion, Ohio.

355. "Make Icy Pavements Safe With Rock Salt" is an authoritative booklet describing one of the most effective and economical methods of winter ice control. International Salt Co., Scranton, Pa.

356. Snow Insurance, an excellent 24-page booklet that tells you a lot about the economics of snow removal from city streets. Barber-Greene Co., Aurora, Ill.

357. Hydraulic Controls provide "fingertouch" ease in handling snow plows, and are simpler, quicker and permit higher operating speeds. For information on installation on present plows, ask for Bulletins 36-12 and 36-13. Vickers, Inc., 1412 Oakman Blvd., Detroit, Mich.

358. Snow Fence. Folder describes Beach fence and gives information on details of construction, location, etc. Beach Mfg. Co., Charlotte, Mich.

359. "Avoid Winter Tie-Ups." A folder describes various types of thawing equipment and their uses. Hauck Mfg. Co., 124-136 Tenth St., Brooklyn, N. Y.

360. 24-page booklet "Thawing Outfits" contains much information on electrical thawing of services and mains. Large and small outfits. W. S. Darley & Co., 2810 Washington Blvd., Chicago, Ill.

Setting and Testing Equipment for Water Meters

430. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

432. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

435. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Incineration

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 214 West Huron St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 570 Lexington Ave., New York, N. Y.

Water Works Operating Practices

490. This is a reprint of two excellent papers by F. E. Stuart. One outlines a number of filtration and field practices of value. The other presents a lot of kinks the author has picked up in visits to more than 1,000 water works plants. Sent free by Activated Alum Corp., Curtis Bay, Baltimore, Md.

Drawing Supplies

495. Perspective and Isometric paper, graph paper, tracing paper, blue print hangers, automatic (irregular) curves, adjustable curves, multi-purpose charting papers, etc. Write for illustrated bulletin. Wade Instrument Co., 2246-PW, Brooklyn Station, Cleveland, Ohio.

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

Industrial Lighting Equipment:

This book covers porcelain enameled lighting fixtures for all industrial purposes. In addition to complete listings of all standard and special fixtures for indoor and outoor use its 200 pages contain an engineering section with simplified data which includes floodlighting layouts and recommendations for the illumination of many specialized as well as standard industrial jobs. Copies from Goodrich Electric Company, 2900 N. Oakley Avenue, Chicago, Ill. Ask for Catalog No. 38.

American Standard Safety Codes

The following safety codes are available from the American Standards Assn., New York, N. Y., at the prices stated.

A10-1934 Manual of Accident Prevention in Construction *Am. Std.* (*Under Revision*) $2.00

The *Manual of Accident Prevention in Construction* was prepared under the supervision of the Accident Prevention Committee of the Associated General Contractors of America. The preface, foreword, and introduction include discussions on the need for accident-prevention practices in the construction industry, compiling accident records, effect of safety on morale, insurance, and rates, and savings due to accident prevention measures.

About 50 pages are devoted to a scheme of organization in which are suggested numerous details of a safety program.

The main part of the *Manual* covers safe practices on construction work with sections on 43 different phases of this problem.

D6-1935 Manual on Uniform Traffic Control Devices for Streets and Highways *Am. Std.* 50c

This standard was prepared by a Joint Committee on Uniform Traffic Control Devices appointed by the American Association of State Highway Officials and the National Conference on Street and Highway Safety. It was later submitted to and approved by the American Standards Association.

The four main sections of this standard cover signs, markings (regulatory, guidance and warning), signals (traffic control and flashing), and islands (safety zones and traffic islands). Regulations are given covering legal authority; correct and consistent application; shape, color, materials, dimensions, message, etc., of the design; location and installation, and maintenance. There are 18 pages of illustrations of the requirements and five appendices giving special information.

A13-1928 Scheme for the Identification of Piping Systems *Am. Rec. Practice* 50c

This standard was developed for the purpose of providing industrial plants and organizations of various kinds with a uniform system of colors for the identification of piping systems, so that the designations showing which pipes contain materials safe to handle, and which contain unsafe materials, may be the same in all cases.

The main part of the code defines piping systems, fire-protection, materials and equipment, dangerous and safe materials, protective materials, and extra valuable materials. It also provides a method of identification of piping; a classification by color; and detailed instructions for working out a standard identifications scheme.

Appendix A includes a classification of materials carried in pipes; Appendix B, identification by colors; Appendix C, description of colors for special application; and Appendix D, identification of piping systems by legends.

Z4.2-1935 Specifications for Drinking Fountains *Am. Std.* 10c

These specifications, based on the requirements contained in Bulletin 87 of the Women's Bureau, U. S. Department of Labor, cover: Material of fountain; material of nozzle; protection of nozzle; bubbler and bowl of fountain; drain from fountain; water supply pipe and valve; height of fountain; waste opening and pipe.

Booklets and Catalogs

Maintenance Equipment is the title of a new catalog just issued by Littleford Bros., Cincinnati, O. It specializes on their asphalt and tar heating and melting equipment, describing the new ideas and advances in design of the past two years.

Curing Concrete Roads with Silicate of Soda, 1937 edition, is a 16-page text telling about the advantages of this method of curing, and describing in detail the procedure. Philadelphia Quartz Co., Philadelphia, Pa.

Rain, Snow and Water Level Gauges is another of those beautiful and technically valuable catalogs issued by Julien P. Friez Co., Baltimore, Md. The pictures and typography are outstanding. Those interested in water and water resources, flood control, irrigation, power and soil conservation will find it useful.

Rotating Plunger, Heliquad and High Vacuum Pumps are described in a new catalog issued by Kinney Mfg. Co., 3543 Washington St., Boston, Mass. These are for handling all kinds of liquids from acetic acid through the alphabet to asphalt, oil, tar and hot water. Sectional views and sizes, displacements, pressures and other data are given.

Turbine Pumps are furnished in capacities up to 75 gpm and for heads up to 700 ft. by Roots-Connersville Blower Corp., Connersville, Ind. A new bulletin describes these and gives selection data.

Packings, featuring the eleven most commonly used U. S. packings which meet a large percentage of normal requirements, is a handy reference for engineers and plant operators. Mechanical Goods Division, United States Rubber Products, 1790 Broadway, N. Y.

Steam and Deep-Well Turbine Pumps are described in three bulletins issued by Fairbanks, Morse & Co., Chicago, Ill. The steam pump bulletin describes units for oil and water for pressures up to 420 pounds and quantities to 464 gpm; the deep well turbines (2 publications) are in sizes from 4 to 16 ins., capacities to 2300 gpm, and lifts to 400 ft.

Waterproofing and Corrosion Prevention. Dr. A. F. Pistor of Inertol Co., Inc., 401 Broadway, N. Y., has reviewed briefly developments in this field. A reprint is available from the above company.

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